Capital Structure and Regulation: Do Ownership and Regulatory Independence matter?

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We study the effect of ownership structure and regulatory independence on the interaction between capital structure and regulated prices using a comprehensive panel data of publicly traded European utilities. We find that firms in our sample tend to have a higher leverage if they are privately controlled and regulated by an independent regulatory agency. Moreover, the leverage of these firms has a positive and significant effect on their regulated prices, but not vice versa. Our results are consistent with the theory that privately controlled regulated firms use leverage strategically to obtain better regulatory outcomes.

1. Introduction

The wave of privatization and institutional reforms that swept network industries in Europe during the 1990s dramatically affected the incentives, strategies, and performance of regulated utilities. One peculiar and often neglected aspect of this process is the change in their capital structure: casual observation suggests that regulated utilities have substantially increased their financial leverage since the early 1990s. This trend is widespread across countries and across sectors, and seems to be independent of the leverage boom that fed the global crisis in the second half of 2000s. For example, Telefonica de Espana, the Spanish incumbent telecom operator, increased its leverage after being privatized in 1997 from 36% to 68% in 2005; Autostrade per l'Italia, the largest freight road operator in Italy, increased its leverage from 32% in 1999, when it was completely privatized, to 88% in 2003; National Grid Group Plc, the UK energy transport operator, increased its leverage from 30% in 1997 to 72% in 2005; and Anglian Water Plc, the largest water company in England and Wales, raised its leverage from 7% in 1997 to 49% in 2005. A joint study of the UK Department of Trade and Industry (DTI) and the HM Treasury (DTI-HM, 2004) has expressed a concern about the "dash for debt" or "flight of equity" within the UK utilities sector from the mid-late 1990s and argued that such high leverage "could imply greater risks of financial distress, transferring risk to consumers and taxpayers and threatening the future financeability of investment requirements" (DTI-HM, 2004, p. 6).[1] Similar concerns have been recently expressed by the Italian energy regulatory agency,

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1. For a related report, see Ofwat and Ofgem (2006). In December 2008, the UK energy regulatory agency, Ofgem, published a position paper that sets out the arrangements for responding in the event that a network company experienced financial distress (see Ofgem, 2008). In particular, Chapter 4 of the position paper considers the scope for reopening a price control in case of a financial distress, the factors that are likely justify this procedure, and its key elements.

AEEG, which announced its intention to start monitoring the financial leverage of Italian energy utilities in order to discourage speculative behavior that might jeopardize their financial stability (see AEEG, 2007; p. 38).

Given these concerns, it is clearly important to understand the determinants of the capital structure of regulated firms and its implications for regulated prices. Existing empirical literature has focused, however, almost exclusively on the U.S., where the high leverage of privately owned regulated utilities is a well-known and well-documented phenomenon.[2] Yet, the institutional framework in Europe differs from that in the U.S. in at least two important respects. First, while large utilities in the U.S. were always privately owned, private ownership and control of utilities in the EU is still the exception rather than the rule—despite the privatization wave of the last two decades, many EU utilities are still controlled by central or local governments (see Bortolotti and Faccio, 2008). Second, utilities in the U.S. were subject to rate regulation by state and federal regulatory commissions since the 1910s. In the EU by contrast, Independent Regulatory Agencies (IRA) were established only recently and are fully operational only in the energy and the telecom sectors; in other sectors, such as transports and water, utilities are still regulated directly by ministries, governmental committees, or local governments.

In light of these institutional differences, we believe that it is important to study the capital structure of regulated utilities in the EU and its interaction with regulated prices, and examine if and how this interaction varies across ownership structures and whether and how it is affected by the existence of an IRA. To this end, we have constructed a comprehensive panel data on 92 publicly traded EU utilities over the period 1994–2005. Our data covers practically all major publicly traded regulated utilities in the EU-15 member states before the 2004 enlargement. These firms were involved in major privatization transactions that account for almost a half of the EU-15 total privatization revenues across all sectors (including banking and insurance, oil companies, basic materials, and consumer goods).

To the best of our knowledge, our paper is the first systematic study of the capital structure of EU utilities and the first to examine empirically the relationship between capital structure, regulated prices, ownership structure, and regulatory independence. Our analysis reveals the following:

2. See for example, Bowen, Daly, and Huber (1982), Bradley, Jarrell, and Kim (1984), Smith (1986), and Barclay, Marx, and Smith (2003).

(i) Firms tend to have higher leverage when they are privately controlled and regulated by an IRA.
(ii) When firms are privately controlled and regulated by an IRA, leverage Granger-causes regulated prices (but not vice versa). When firms are state controlled, levterage and regulated prices do not Granger-cause one another.

These results hold even after controlling for various firm-specific characteristics such as size, asset tangibility, profitability, and non debt tax shield, and for key features of the macroeconomic and institutional environment, such as the growth rate of GDP, the political orientation of the government, and the strength of the legal protection of investors' rights. Result (i) suggests that the "dash for debt" phenomenon is a by-product of the transition towards private-control of utilities in the EU and regulation by independent agencies. Result (ii) supports the concerns of regulators that the financial leverage of regulated firms may lead to higher prices. However, leverage does not necessarily hurt consumers: to the extent that high prices boost the incentives of regulated firm to invest, it may benefit consumers by allowing them to enjoy better and more reliable services.

As mentioned earlier, existing empirical studies on the capital structure of regulated firms have mainly focused on the U.S. Taggart (1985) finds that electric utilities have increased their debt-to-equity ratios following the introduction of rate regulation in various states in the U.S. in the 1910s. He argues that this increase may have been due to the fact that state regulation made the business environment safer for utilities, but cannot rule out the possibility that some utilities may have adopted higher debt-to-equity ratios in an attempt to win price concessions from regulators. Hagerman and Ratchford (1978) show that, for a sample of 79 electric utilities in 33 states, the allowed rate-of-return on equity is increasing in the debt-equity ratio.[3] Dasgupta and Nanda (1993) study a cross-section of U.S. electric utilities, and find that firms operating in less pro-firm regulatory environments tend to have higher debt-equity ratios. Klein, Phillips and Shiu (2002) study a cross-section of U.S. property-liability insurers and find strong and robust evidence that the degree of price regulation and its stringency have positive effects on the insurers' leverage. Bulan and Sanyal (2005) study a panel of U.S. investor-owned electric utilities for the period 1990–2000 and find that they reduced their debt-to-total assets ratios in response to the heightened regulatory and competitive uncertainty created by

3. Besley and Bolton (1990) find in a survey of 27 regulatory agencies and 65 utilities that approximately 60% of the regulators and utilities surveyed believe that an increase in debt relative to equity increases regulated prices.

the deregulation process. Bulan and Sanyal (2006), use a similar panel to show that after deregulation, U.S. investor-owned electric utilities respond to growth opportunities in a two-step process: first, they accumulate financial slack in anticipation of new growth opportunities, but then, when the growth opportunities become more viable, they use debt finance to finance them. Ovtchinnikov (2008) studies a large sample of U.S. firms in industries that were subject to some form of deregulation during the 1966–2006 period, including entertainment, petroleum and natural gas, electricity, telecommunications, and transportation. He finds that following deregulation, firms reduce their leverage by about 30%, and moreover, leverage becomes much less negatively correlated with profitability and market-to-book ratios and much more positively correlated with firm size. To the best of our knowledge, the only paper that does not focus on the U.S. is Correia da Silva, Estache and Jarvela (2006). They examine the leverage of 121 regulated utilities in 16 less developed countries over the period 1991–2002 and find that leverage varies significantly across sectors, with the highest leverage being observed in transportation and the lowest in water supply. They also find that leverage steadily increases over time while investment levels fall.

The rest of the paper is organized as follows. Section 2 provides a brief institutional framework of the regulatory environment in the EU. Section 3 presents the theoretical background and the empirical implications that we test. We describe our panel data in Section 4 and present our empirical results in Sections 5 and 6. Concluding remarks are in Section 7.

2. Background: Liberalization and Structural Reforms in European Network Industries

Following a big wave of nationalization after the Second World War, network industries in Europe were largely dominated by vertically integrated, stated-owned, monopolies. Under this regime, utilities were viewed as an operational branch of the government and were instructed to provide universal services at low prices, absorb unemployment, and invest in infrastructure. The government in turn played the dual role of owner and "regulator," and set tariffs, quality standards, and investment levels. This arrangement however created ill-performing and highly inefficient public monopolies (Megginson and Netter, 2001).

Starting from the mid 1980s, the European Commission has promoted a gradual liberalization process intended to improve the efficiency and service quality of EU public utilities and boost their

investments. In particular, the European Commission has enacted a number of directives aimed at setting up a common regulatory framework for EU member states, which were in turn required to transpose these directives into national legislation. However, the Commission left the decision about the ownership structure of utilities in liberalized markets entirely in the hands of national governments. As a result, many privatized utilities in the EU are still partially owned either by state or by local governments, despite being publicly traded in the stock exchange. In some cases, the state holds a "golden share" in the firm that grants the state special control rights, including the right to appoint board members, veto proposed acquisitions, and cap shareholders' voting rights.[4]

The extent of effective liberalization varies considerably across member states and across industries. In telecommunications, liberalization started in 1987 with the publication of the Green Paper for the Development of the Common Market for telecommunication services and equipment. The Green Paper was followed by a sequence of directives, starting from Directive 90/388 on "Competition in the markets for telecommunications services," which established the institution of national IRAs in each member state.[5] In the energy sector, the European Commission has been undertaking legislative actions since 1988 to establish an internal energy market for both electricity and natural gas within the EU. The milestone legislation is Directive 96/92 for the electricity, followed by Directive 98/30 for the gas market; these directives aimed at gradually introducing competition in generation/production and distribution, and at unbundling the different segments in the energy value chain. Importantly, these directives established independent national regulatory agencies.[6] Table I shows the year in which an IRA in telecommunications and in energy were established, as well as the extent of privatization in these years. The table shows that in most cases, the establishment of an IRA preceded large scale privatization, which is consistent with EU policy guidelines that required member states to "ensure effective structural separation of the regulatory functions from

4. For a more comprehensive analysis of the privatization process in Europe, see Bortolotti, Fantini, and Siniscalco (2003).

5. Art. 7 Directive 90/388/EC and also preamble 11 to Directive 96/19/CE.

6. Art. 20 Directive 96/92/EC and Art. 21 of Directive 98/30/EC. Initially, the national energy IRAs were granted powers to settle disputes among operators and were only required to be independent from the regulated firms. Over time, however, EC legislation has broadened the powers of the IRAs to encompass the responsibility for ensuring nondiscrimination, effective competition, and the efficient functioning of the market, along with the implementation of unbundling rules (see Art. 23 Directive 2003/54 and Art. 25 Directive 2003/55).

Table I.
The Timing of Regulation and Privatization in the Energy and Telecommunications Sectors in the EU-15 Member States

	Energy (Electricity and Gas)		Telecommunications	
Country	Date of Establishing an Energy IRA	Privatization Revenues before an IRA was Established	Date of Establishing a Telecom IRA	Privatization Revenues before an IRA was Established
Austria	2000	70.8%	1997	0%
Belgium	1999	10.1%	1991	0%
Denmark	1999	0%	2002	100%
Finland	1995	0.4%	1987	0%
France	2000	2.5%	1996	2.2%
Germany	2006	100%	1996	0%
Greece	2000	0%	1992	0%
Ireland	1999	n.a.	1997	0%
Italy	1995	0%	1997	5.7%
Netherlands	1998	0%	1997	41.9%
Portugal	1995	12.9%	2001	100%
Spain	1998	52.6%	1996	22.2%
Sweden	1998	0%	1992	0%
UK	1989	18.6%	1984	3.1%

activities associated with ownership or control" (Directive 97/51 for the telecommunication industry; see also Gilardi, 2005).

Unlike the telecommunications and energy sectors, the liberalization efforts in the water and transportation sectors are still in early stages. At present, privatization activity is still limited, and, with the exception of the UK, where firms were privatized and two IRAs were established to regulate the water industry (Ofwat) and the railway industry (ORR), no IRAs were yet established, and privatization is still extremely limited and occurred in only six member states.

3. Theoretical Predictions

Regulators set the prices of regulated firms by explicitly taking into account the firm's capital structure. In the U.S., this practice stems from the need to ensure regulated firms a "fair rate of return" on their investments (see, e.g., Spulber, 1989). This fair rate of return depends, among other things, on the firm's cost of capital, which in

turn depends on the firm's capital structure.[7] Under *RPI-X* regulation that is widely used in the EU, regulators set price caps that ensure that the regulated firm's revenue will cover its operating costs, depreciation, and infrastructure renewals charges, and will yield a sufficiently high return on its capital to induce it to enhance and maintain its network. As in the U.S., the return on capital depends on the firm's capital structure.

The fact that regulated prices are set on the basis of the firm's capital structure suggests that regulated firms can affect their prices by appropriately choosing their capital structure. There are two conflicting views on the link between capital structure and regulated prices. The first view starts with the observation that in practice, regulators often use the firm's Weighted Average Cost of Capital (WACC) in computing the firm's cost of capital that the regulated price is designed to cover. Taggart (1981, Sec. IIB) then shows that as long the allowed return on equity exceeds the after-tax imbedded cost of debt, the regulated firm can induce price increases by substituting equity for debt. The positive effect of equity financing on the regulated price in turn creates a strong incentive for regulated firms to use equity financing. It should be noted, however, that this view is inconsistent with the empirical evidence mentioned in the Introduction that shows that regulated rates-of-return and prices tend to increase with leverage (Hagerman and Ratchford, 1978, and Besley and Bolton, 1990) and that firms tend to increase their leverage in response to regulation (Taggart, 1985, and Ovtchinnikov, 2008), and it is also inconsistent with the recent concern in the U.K. and in Italy regarding the "dash for debt" of regulated utilities.

An alternative view, advanced by Taggart (1981, Sec. IIC), Spiegel and Spulber (1994 and 1997), and Spiegel (1994 and 1996) is that regulators are averse to the possibility that the firm they regulated will become financially distressed and therefore raise prices when the firm increases its leverage in order to minimize the risk of financial distress.[8] According to this view, regulated firms have a strong incentive to increase their leverage in order to induce regulators to set high prices. In a recent document, the Italian Corte Dei Conti (National Audit

7. The Supreme court of the U.S. stated in an early decision from 1898, *Smyth v. Ames* (1898) 169 U.S. 466, that "what the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience." In its landmark decision *Federal Power Comm. v. Hope Natural Gas Co.* (1944) 320 U.S. 591, the Supreme court elaborated on the concept of "fair return" and stated that "the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks."

8. For example, Owen and Braeutigam (1978) argue that "One of the worst fears of a regulatory agency is the bankruptcy of the firm it supervises, resulting in "instability" of services to the public or wildly fluctuating prices."

Office) expressed a similar opinion and wrote that "Privatized firms strategically increase the risk of insolvency in order to obtain higher tariffs to finance investments. The regulated firm uses leverage as a commitment device vis-à-vis the regulator to maintain a high level of profitability."[9] Of course, the strategic effect of leverage on prices begs the question why regulators do not restrict the leverage of regulated firms.[10] Spiegel (1994, 1996) provides a possible answer to this question by showing that the increase in regulated prices due to leverage may lead to more efficient investment choices by the regulated firm.

The above theoretical predictions are based however on the implicit assumption that the regulated firm is privately owned and regulated by an IRA. But as mentioned in Section 1, many European utilities are still state-controlled and in many cases, are still regulated by ministries, governmental committees, or local governments rather than by an IRA. These institutional features have important implications.

First, when the state controls the regulated firm, it plays the dual role of an owner and a regulator. Hence, unlike privately controlled regulated firms, state-controlled regulated firms do not need to use their capital structure strategically as a way to induce higher prices.

Second, it is often argued that IRAs have a better ability to make credible long-term commitments to regulatory policies than ministries and government agencies (see e.g., Levy and Spiller, 1994, and Gilardi 2002 and 2005). An empirical support for this argument is provided by Guasch, Laffont, and Straub (2008). They study a sample of 307 transportation and water concession contracts in Argentina, Brazil, Chile, Colombia, and Mexico over the period 1989 to 2000,[11] and find that although 45% of the transport concession contracts and 71% of

9. See Corte Dei Conti, "Obiettivi E Risultati Delle Operazioni Di Privatizzazione Di Partecipazioni Pubbliche," Roma, February 10, 2010, p. 195, available at http://www.cnim.it/cnimnm/articlefiles/407-Privatizzazioni%20definitivo%20-%20relazione.pdf. See also p. 219 for a similar statement.

10. In the U.S. regulatory commissions allow regulated firms to exercise discretion in choosing their capital structures (see Phillips, 1988). For example, the Colorado Supreme Court in *Re Mountain States Teleph.* & *Teieg. Co.* (39 *PUR* 4th 222, 247–248) stated that "a guiding principle of utility regulation is that management is to be left free to exercise its judgment regarding the most appropriate ratio between debt and equity." As for the EU, we are not aware of any case in which EU regulators have interfered with the financing decisions of a privatized regulated firm.

11. A concession is the right to use the assets of a former state company for a limited period of time (usually 20 to 30 years), being fully responsible for all investments and having to secure a number of targets specified in the contract. At the end of the concession, all the assets go back to the government. In a sense then, concessions could be viewed as limited-term privatizations. Guasch, Laffont, and Straub (2008) report that during the 1990s concessions have been used in 67% of the private sector participation cases worldwide, all sectors included.

the water concession contracts were renegotiated, the presence of an IRA lowered the probability of renegotiation by 5%–7.3%. This effect is significant given that the average probability of renegotiation of any individual contract at any point in time is around 1%. The better ability of IRAs to make long-term commitments suggests that IRAs are less likely to cut prices once the firm's investment is sunk and thereby benefit consumers at the expense of the firm's owners.[12] This implies in turn that privately controlled firms which are subject to regulation by IRAs anticipate, other things being equal, higher regulated prices and hence a lower risk of financial distress. As a result, these firms are likely to issue more debt. In other words, the cost of using debt strategically in order to induce regulators to raise prices is cheaper when regulators are independent and hence, regulated firms are expected to have a higher leverage when facing an independent regulator.[13]

Taggart (1981) suggests another reason why leverage may be higher when the firm is regulated by an IRA: he argues that lags or uncertainties in the regulator's reaction to the firm's capital structure decision weaken the firm's incentive to manipulate its capital structure in an attempt to influence the regulated price. As a result, the regulated firm has a stronger incentive to issue debt when it faces effective regulators who are expected to respond in an immediate and predictable way to changes in the firm's financing mix.

A third reason why leverage may be higher when the firm is regulated by an IRA is that when the state acts as a regulator, the firm may lobby the state directly to obtain more favorable terms and hence may not have to use leverage strategically in order to achieve the same goal.

The two hypotheses that we test in this paper are therefore as follows:

Hypothesis 1: Conditional on the existence of an IRA, privately controlled regulated firms will have a higher leverage than state-controlled firms.

12. Henisz and Zelner (2001) study data from 55 countries over 20 years and find that stronger constraints on executive discretion, which improves their ability to commit not to expropriate the property of privately owned regulated firms, leads to a faster deployment of basic telecommunications infrastructure. Li (2009) examines data on 22 mobile carriers from 7 countries over the time period 1995–2007 and shows that regulatory independence is associated with a higher mobile penetration and network expansion, and greater technical efficiency, TFP growth and innovation. Moreover, this effect is particularly significant when firms are privately controlled.

13. Cambini and Spiegel (2011) formalize this idea in the context of a theoretical model that explicitly accounts for partial ownership of the regulated firm by the state and for the regulator's ability to make long-term commitments. They show that the regulated price is an increasing function of the firm's debt level, but the value of this function is higher in the presence of an IRA. As a result the cost of issuing debt is lower for firms that face an IRA and hence these firms end up having a higher leverage.

Hypothesis 2: An increase (decrease) in leverage leads to an increase (decrease) in regulated prices provided that the firm is privately controlled and regulated by an IRA.

Hypotheses 1 and 2 exploit the heterogeneity in our sample across ownership structures (private vs. state control) and regulatory frameworks (independent vs. non independent regulatory agencies) to examine the strategic interaction between regulation and capital structure.

4. Data and Main Variables

Using *Worldscope*, we identify publicly traded firms operating in regulated sectors during the period 1994–2005 in the EU-15 member states. We define regulated sectors to be those in which entry and prices are subject to regulatory oversight either by the state or by an IRA. These sectors include electricity, natural gas, water supply, telecommunications, freight roads concessions, ports, and airports. Excluded from the sample are airlines, oil and refinery companies, and companies operating exclusively in wireless telecommunications or in electricity generation because the prices of these services are typically not regulated.

By applying these selection criteria, we end up with an unbalanced panel of 92 publicly traded utilities and transportation infrastructure operators. In all, we have 44 firms that engage in electricity and gas distribution, 13 water supply companies, 15 telecoms (mainly vertically integrated operators), 8 freight roads concessionaires, and 12 transportation infrastructure operators (airport, ports, and docks). Appendix B lists the firms in our sample and provides relevant information on each firm. Table II provides summary statistics for the main variables we use in the econometric analysis.

As mentioned above, our main objective is to find out if and how capital structure and regulated prices are affected by regulatory independence and by firm ownership. In the rest of this section we describe in detail how we constructed our main dependent variables (leverage and regulated prices) and our main explanatory variables (regulation and ownership). Apart from these variables we also use in our regression analysis in Section 5 various firm level controls that we will described below in the relevant regressions in which they are used.

4.1 Leverage and Regulated Prices

To test our theoretical predictions, it is important for us to use a measure of leverage that captures the risk of default because the theory suggests

Table II.
Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	No. Obs.
		Panel A: Full sample 1994–2005			
Market Leverage	0.181	0.168	0	0.881	765
Book Leverage	0.272	0.215	0	1	889
Real Total Asset (in millions of 2005 dollars)	20,245	32,951	30	205,179	891
Real Sales (in millions of 2005 dollars)	9,262	14,750	4	80,226	891
Tangibility	0.622	0.210	0.034	0.967	890
EBIT-to-Total Asset	0.074	0.099	−1.948	0.299	871
Market-to-Book	1.416	0.736	0.572	14.176	767
Nondebt Tax Shield	0.052	0.03	0	0.183	891
State's UCR	0.348	0.359	0	1	891
		Panel B: Privately controlled utilities (50%)			
Market Leverage	0.191	0.175	0	0.881	537
Book Leverage	0.287	0.222	0	1	552
Real Total Assets (in millions of 2005 dollars)	20,335	28,227	41	156,216	552
Real Sales (in millions of 2005 dollars)	10,083	14,757	4	75,287	552
Tangibility	0.620	0.225	0.034	0.967	551
EBIT-to-Total Asset	0.075	0.104	−1.948	0.293	546
Market-to-Book	1.388	0.575	0.664	9.675	537
Nondebt Tax Shield	0.048	0.029	0.003	0.183	552
State's UCR	0.10	0.15	0	0.499	552
		Panel C: State-controlled utilities			
Market Leverage	0.156	0.150	0	0.757	228
Book Leverage	0.246	0.202	0	1	337
Real Total Assets (in millions of 2005 dollars)	20,097	39,450	30	205,179	339
Real Sales (in millions of 2005 dollars)	7,924	14,640	8	80,266	339
Tangibility	0.625	0.184	0.068	0.962	339
EBIT-to-Total Asset	0.071	0.090	−0.975	0.299	325
Market-to-Book	1.482	1.015	0.572	14.177	230
Nondebt Tax Shield	0.058	0.031	0	0.161	339
State's UCR	0.751	0.196	0.5	1	339

that leverage induces regulators to raise prices in order to minimize the risk of costly financial distress. Therefore, in most of the analysis, our measure of leverage will be market leverage that is defined as total financial debt (both long- and short-term) in book values divided by the sum of total financial debt and the market value of equity.[14] The latter is computed by multiplying the number of outstanding shares at the end of the relevant year by the share price at that date converted into U.S. dollars. It should be emphasized that market leverage can increase (decrease) either because the face value of debt increases (decreases) or because the market value of equity decreases (increases). We believe however that in both cases, the firm becomes more vulnerable to financial distress and hence regulators may be forced to raise regulated prices. In some of our analysis we will also use the book value of leverage, that is, the total financial debt divided by the sum of total financial debt and the book value of equity, as an alternative a measure of leverage to check the robustness of the results.

Accounting and financial market data have been collected from *Worldscope*. Table II shows that the mean market leverage in our sample is 18.1%, while mean book leverage is 27.2%. Moreover, market leverage is higher for privately controlled firms than for state-controlled firms (19.1% vs. 15.6%). Table II reveals a large variability in the debt ratios: market leverage (D/(D + ME)) ranges from 0 to 88%, while book leverage may be as large as 100%.[15] Unreported statistics at the industry level shows that on average, the most highly leveraged firms in our sample are electric utilities with a mean market leverage of 22.8%, followed by multiutilities, 19.2%, and telecoms with a mean market leverage of 17.4%. The least leveraged are airports with a mean market leverage of 5.5%, and ports and docks with a mean market leverage of 8.4%.

To test Hypothesis 2, we need data on regulated prices. Unfortunately, we were unable to find reliable data on regulated retail prices at the individual firm level. Instead, we collected country- and sector-specific retail price indices (see Appendix A for the sources).[16] All price indices are in constant 2005 prices. We believe that given that there is still limited competition in the utilities sectors and given that there is little

14. See Rajan and Zingales (1995) for a discussion of alternative leverage measures. Notice that ideally, market leverage would also include the market value of debt. However, because debt is not always publicly traded, we were unable to find reliable data on the market value of debt. For this reason we also cannot include bond ratings as a control variable in our regression analysis.

15. Only 2 firms in our data have zero leverage: Aereoporti di Firenze and Thessaloniki Water, both are state-controlled.

16. We were unable however to find price indices for airports, ports, and docks, whose services are considered to be intermediate rather than final services.

price dispersion, these price indices appropriately reflect the relevant prices for the firms in our sample.[17]

4.2 Regulation

In order to study the effect of regulatory independence on the interaction between capital structure and regulated prices, we constructed an *IRA* dummy that is equal to 1 in all years in which the firm was subject to regulation by an IRA and equals 0 otherwise, that is when the firm is subject to regulatory oversight by the state or by local governments. Hence, for each sector/country in our dataset, the IRA dummy switches from 0 to 1 in the year when the IRA was set up. The *IRA* dummy was constructed using the inception dates collected by Gilardi (2002) for the energy and telecommunications sectors in which IRAs already exist in all countries in our sample. We complemented this data by drawing from additional sources for freight roads, airports, port and docks, and water. As described in Section 2, except for the water and railway industries in the UK, in all other member states IRAs were not in place in the water and transportation sectors.

4.3 Ownership

In most of our analysis, we define firms as "privately controlled" if the state holds less than 50% of the control rights (otherwise the firm is "state-controlled") and define the year of privatization as the year in which the state's control rights dropped below 50% for the first time. We also examine the robustness of the results by using a more restrictive definition of private control, whereby firms are defined as "privately controlled" if the state holds less than 30% of the firm's control rights instead of 50% (i.e., private investors hold at least 70% of the control rights). Because our sample often exhibits a complex web of cross-ownership patterns among firms (one firm holds the shares of another firm, which in turn holds the shares of a third firm—see Figure 1 for an example), the state may hold both direct as well as indirect control rights in firms. In order to measure the state's ultimate control rights (UCR), we use the weakest link approach (see La Porta, Lopez-de-Silanes, and Shleifer (1999), Claessens, Djankov, and Lang (2000), Faccio and Lang (2002), and Bortolotti and Faccio (2008)). According to this approach,

17. Although the telecommunication sector in the EU was gradually deregulated over time, complete deregulation was present during our sample period only in Finland. As of the end of 2005, price regulation in the form of price caps or some other form of tariff approval was widely applied in the EU, especially for basic voice services (see OECD 2006, Table IX).

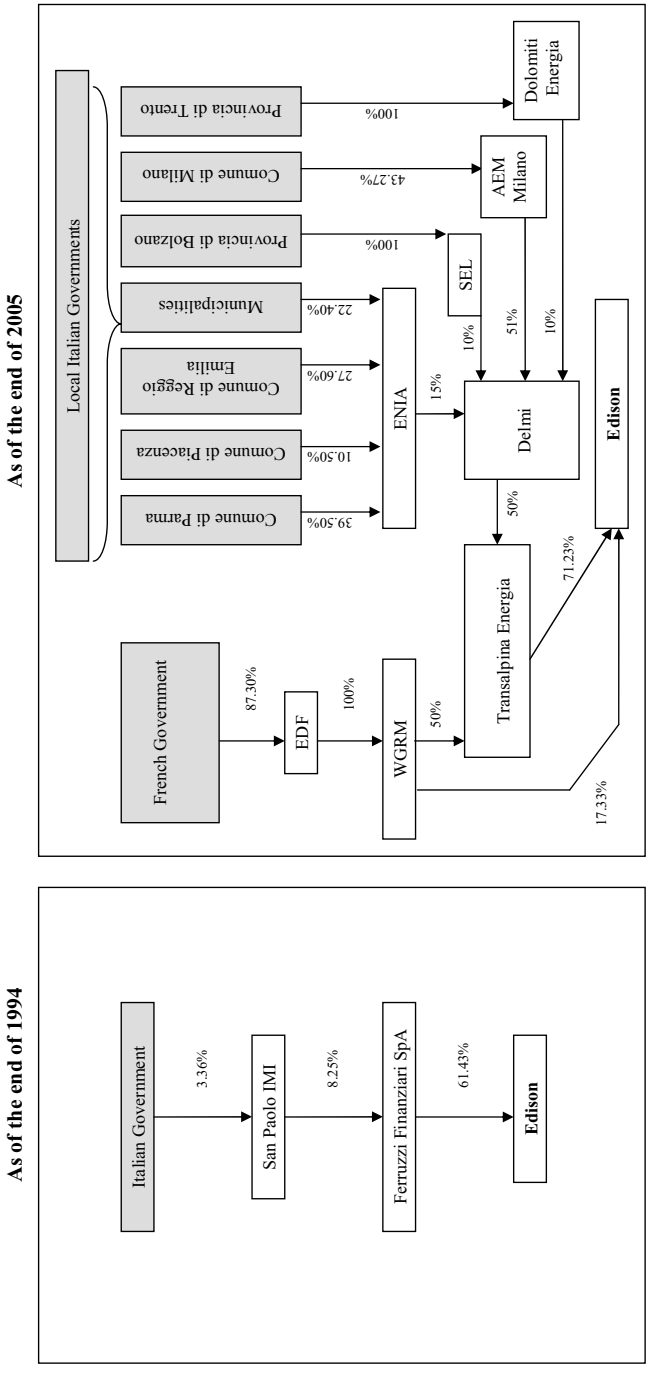

FIGURE 1. THE EVOLUTION OF THE STATE'S CONTROL RIGHTS IN EDISON (ITALY)

the UCR of a given investor (the state in our case) is simply equal to the minimum ownership stake along a chain (i.e., the weakest link). In the case of multiple chains, the UCR's are summed up across all chains.[18] The sources used to compute the state's UCR are listed in Appendix A.[19]

Among the 92 firms in our sample, 43 firms are privately controlled throughout our sample, 25 are state-controlled throughout our sample period, and 24 were privatized during our sample period and hence we observe them before and after their privatization.[20] Table II shows that the mean UCR of the state (including both central and local governments, ministries, and various branches of public administration) in the firms in our sample is 34.8% for the entire sample, 10% for privately controlled firms, and 75.1% for state-controlled firms. In terms of size, the mean total assets of firms in our sample are slightly over 20 billion dollars (in constant 2005 prices) and this figure is similar for privately and state-controlled firms. The mean annual sales (in constant price 2005) are 10,083 million dollars for privately controlled firms and 7,924 million dollars for state-controlled firms.

Our definition of private control may be overstated due to the presence of "golden shares," which give the state special control rights in the firm, including the right to appoint board members, the right to veto proposed acquisitions, and the right to cap the share of voting rights that individual shareholders can own. Our sample includes 11 firms with golden shares (see Table II). Of these firms, 4 are telecoms, 4 are electric utilities, 2 are natural gas utilities, and 1 is an airport. In practically all cases, golden shares are present only when the firm is privately controlled.

5. Empirical Results

Our main goal is to test Hypotheses 1–2 stated in Section 3. In the following subsections we examine these hypotheses in turn.

18. To illustrate, suppose that an investor has an ownership stake of 50% in firm A and 30% in firm B. Firm A in turn has a 30% ownership stake in firm C, while firm B has a 10% ownership stake in firm C. Then, the investor's UCR in firm C is equal to min (50, 30) + min (30, 10) = 40.

19. In some cases, firms in our data have shares with multiple voting rights, although as of May 1998, such shares were outlawed in Italy, Spain, the U.K., and Germany. Unfortunately, our data sources do not report the identity of the owners of these shares and hence we must treat them as ordinary shares. As a result, our data on state's UCR may be biased downward.

20. To the best of our knowledge, none of the 25 firms in our sample that were still state-controlled by the end of 2005 was privatized in 2006–2009.

Table III.
Mean Market Leverage by Ownership and Regulation Types

	Total Observations $N = 765$	IRA Exists $N = 464$	IRA does not Exist $N = 301$	Regulation Difference p-value
Panel A: Mean market leverage 1994–2005 (50% control threshold)				
Total observations		19.9%	15.2%	4.7%
		(0.8%)	(0.9%)	$p = 0.0001$
Privately controlled	19.1%	20.7%	16.4%	4.3%
	(0.7%)	(0.9%)	(1.1%)	$p = 0.004$
	$N = 537$	$N = 333$	$N = 204$	
State-controlled	15.6%	17.8%	12.7%	5.1%
	(0.9%)	(1.2%)	(1.5%)	$p = 0.010$
	$N = 228$	$N = 131$	$N = 97$	
Ownership difference	3.4%	2.9%	3.6%	
p-value	$p = 0.009$	$p = 0.103$	$p = 0.058$	
Panel B: Mean market leverage 1994–2005 (30% control threshold)				
Total observations		19.9%	15.2%	4.7%
		(0.8%)	(0.9%)	$p = 0.0001$
Privately controlled	19.4%	21.0%	16.6%	4.4%
	(0.8%)	(1.1%)	(1.3%)	$p = 0.0131$
	$N = 434$	$N = 279$	$N = 155$	
State-controlled	16.3%	18.2%	13.7%	4.5%
	(0.8%)	(1.1%)	(1.2%)	$p = 0.006$
	$N = 331$	$N = 185$	$N = 146$	
Ownership difference	3.1%	2.8%	2.85%	
p-value	$p = 0.009$	$p = 0.086$	$p = 0.115$	

Market Leverage is total financial debt divided by the sum of total financial debt and the market value of equity. The latter is based on the price and number of outstanding shares at the end of the relevant year in U.S. dollars. Firms are defined "privately controlled" if the state's UCR does not exceed 50% (Panels A and C) or 30% (Panels B and D) and are defined as "state-controlled" otherwise. (Standard errors are in parenthesis). The p-values are based on two-sided test of the Null hypothesis that the difference in the average leverage between two different groups is equal to 0.

5.1 Leverage

In total, we have 765 firm-year observations on market leverage (in the regression analysis below, the sample size is lower due to missing data in some control variables). We begin by dividing these observations into four groups, depending on whether firms are privately- or state-controlled and whether they are regulated by an IRA or by some branch of the government. In Table III we report the mean leverage of each group. Panel A shows that irrespective of whether an IRA

exists, the mean market leverage of regulated firms is significantly higher if they are privately controlled, and irrespective of ownership, the mean leverage is higher when an IRA exists. Panel B of Table III shows that these results continue to hold when we use a more stringent definition of private-control (i.e., firms are defined as privately controlled only if the state's UCR are 30% or less rather than 50% or less). Overall, Table III shows that the mean market leverage of firms is particularly high when they are privately controlled and subject to regulation by an IRA (20.7% in Panel A and 21% in Panel B) and is particularly low when they are state-controlled and not subject to regulation by an IRA (12.7% in Panel A and 13.7% in Panel B).

The preliminary results in Table III suggest that both the ownership structure and the existence of an IRA matter for the financial structure of regulated firms. In particular, leverage tends to be higher when firms are privately controlled and when an IRA exists. Of course, these results are only suggestive because we are yet to control for various possible alternative determinants of capital structure. We therefore turn now to a regression analysis.

Our core specification is the following:

$$L_{it} = \alpha_0 + \alpha_1 Private\ Control_{it} + \alpha_2 IRA_{it} + \alpha_3 Private\ Control_{it} \times IRA_{it} + \alpha_4 \mathbf{X}_{it} + \alpha_5 \mathbf{Y}_{it} + \sum_n \mu_{in} Country_n + \sum_j \rho_{ij} Sector_j + \sum_t \lambda_t Year_t + \varepsilon_{it}, \quad (1)$$

where L_{it} is the *Market Leverage* of firm i in year t, $Private\ Control_{it}$ is a dummy that is equal to 1 if firm i was privately controlled in year t and is equal to 0 otherwise, IRA_{it} is a dummy that is equal to 1 if firm i was subject to regulation by an IRA in year t and is equal to 0 otherwise, $\mathbf{X}_{it}$ is a vector of firm-specific variables, $\mathbf{Y}_{it}$ is a vector of country-specific variables, *Country*, *Sector*, and *Year* are country, sector, and year dummies, and ε_{it} is an error term.

The vector $\mathbf{X}_{it}$ of firm-specific variables includes various firm characteristics that were shown in the empirical corporate finance literature to be reliable determinants of capital structure.[21] Our main goal is to find out if ownership structure and regulatory independence have a significant effect on leverage (as we show in Table III) even after controlling for these alternative potential determinants of capital structure. Specifically, the vector $\mathbf{X}_{it}$ includes the log of real total assets to control for firm's size (size is typically shown to have a positive effect

21. For common firm characteristics that are included in leverage regressions see for example, Titman and Wessels (1988), Rajan and Zingales (1995), Fama and French (2002), and Frank and Goyal (2007).

of leverage), the ratio of fixed to total assets that reflects asset tangibility (tangible assets can serve a collateral and hence lower the cost of debt financing), the ratio of EBIT (earnings before interests and taxes) to total assets that is a proxy for profitability and "efficiency," (more efficient firms are likely to have higher earnings with the same assets), and the ratio of depreciation and amortization to total assets as a proxy for nondebt tax shields (tax deductions for depreciations are substitutes for the tax benefits of debt financing).

Given that our sample covers firms from 14 different countries over a period of 12 years, we include in the regression a vector $\mathbf{Y}_{it}$ of time-varying country-specific variables that includes *GDP Growth* to account for differences in macroeconomic conditions over time, a *Political Orientation* index that measures the political orientation of the government, and an *Investor Protection* index that measures the legal protection of shareholders' rights (the latter two indices appear in only some of our specifications). The *Political Orientation* index ranges from 0 (extreme left wing) to 10 (extreme right wing) and is computed as the weighted average of the right-left political orientation scores of the parties forming the executive branch of government, where the weights are equal to the number of parliamentary seats held by each party divided by the total number of parliamentary seats held by the ruling coalition as a whole (see Huber and Inglehart, 1995, and Bortolotti and Faccio, 2008). We expect higher values of the *Political Orientation* index to be associated with more pro-firm regulation (this is true even when an IRA exists although naturally to a lesser extent). The *Investor Protection* index we use is the "anti-director rights" index developed by La Porta et al. (1998) and updated by Pagano and Volpin (2005). We expect that higher values of this index would be associated with lower cost of equity and hence lower leverage.

The regulatory and institutional environment in our sample may differ across sectors, across countries, and over time. One way to control for unobserved characteristics of the regulatory and institutional environment (like the effectiveness of the regulatory rules, the regulatory climate, the internal organization of the regulatory body, etc.) is to include country and sector dummies. Unfortunately, time invariant country- and sector-specific dummies cannot be estimated by the fixed effects model because they are perfectly collinear with the firm fixed effects. Therefore, we often rely on random effect estimation that allows us to include country- and sector-specific dummies and which is more efficient. This approach is valid however only when the firm-specific effect included in the error term is not correlated with the regressors. To

ensure that this is the case, we perform the Hausman (1978) specification test and report the associated *p*-values along with the results.[22]

Our main interest in the leverage regressions is with the effects of ownership and regulatory independence on leverage; these effects are captured by the *Private Control*, *IRA*, and *Private Control* × *IRA* dummies. The following table conveniently summarizes the value of the intercept in equation (1), depending on the firm's ownership and regulatory structures and the ownership effect controlling for the existence of IRA as well as the IRA effect controlling for ownership type.

	IRA	No IRA	IRA effect
Privately controlled	$\alpha_0 + \alpha_1 + \alpha_2 + \alpha_3$	$\alpha_0 + \alpha_1$	$\alpha_2 + \alpha_3$
State-controlled	$\alpha_0 + \alpha_2$	α_0	α_2
Ownership effect	$\alpha_1 + \alpha_3$	α_1	

From the table it is clear that the sum of the coefficients of the *Private Control* and the *Private Control* × *IRA* dummies, $\alpha_1 + \alpha_3$, captures the effect of ownership (private- vs. state-control) on the leverage of firms that are regulated by an IRA, while the coefficient of the *Private Control* dummy, α_1, captures the effect of ownership on the leverage of firms that are not regulated by an IRA. Likewise, the sum of the *IRA* and the *Private Control* × *IRA* dummies, $\alpha_2 + \alpha_3$, captures the effect of regulatory independence (IRA vs. no IRA) on the leverage of privately controlled firms, while the coefficient of the *IRA* dummy, α_2, captures the effect of regulatory independence on the leverage of state-controlled firms. Hypothesis 1 predicts that the sum of $\alpha_1 + \alpha_3$ is positive and significant. Apart from this prediction it is also interesting to examine the effect, if any, that IRA has on the leverage of privately controlled firms. In the regression below we will therefore report the *p*-values associated with the tests on the significance of $\alpha_1 + \alpha_3$ and $\alpha_2 + \alpha_3$.

Table IV tests our baseline specifications, using alternative estimation techniques. Columns (1) and (2) report estimation results using OLS on pooled data. A full set of time dummies is included in all columns. In Column (2) we add country and sector dummies and also interact these dummies to allow the sector effects to vary across different countries. In Column (3) we report fixed effect estimates that allow us to control for firm-specific fixed effects, but not for unobserved

22. If our model is correctly specified, and if the firm fixed effect is uncorrelated with the explanatory variables, then the (subset) of coefficients that are estimated by the fixed effects estimator and by the random effects estimators should not statistically differ.

Table IV.
Leverage, Regulation and Ownership: The Baseline Equation

Market Leverage	(1) OLS	(2) OLS	(3) Fixed Effects	(4) Random Effects	(5) Fixed Effects	(6) Random Effects
Log of real total assets	0.028***	0.020*	0.084***	0.035***	0.084***	0.034***
	(*0.005*)	(*0.010*)	(*0.025*)	(*0.010*)	(*0.025*)	(*0.010*)
Fixed-to-total assets	−0.106*	−0.118*	−0.242***	−0.131**	−0.242***	−0.120**
	(*0.055*)	(*0.062*)	(*0.090*)	(*0.055*)	(*0.090*)	(*0.057*)
EBIT-to-total assets	−0.356***	−0.326***	−0.316***	−0.322***	−0.323***	−0.332***
	(*0.081*)	(*0.076*)	(*0.078*)	(*0.079*)	(*0.078*)	(*0.079*)
Nondebt tax shield	−0.957***	−1.200***	−0.939*	−1.187***	−0.978**	−1.202***
	(*0.306*)	(*0.437*)	(*0.492*)	(*0.405*)	(*0.500*)	(*0.403*)
GDP growth	−0.019**	−0.030***	−0.027***	−0.029***	−0.026***	−0.028***
	(*0.008*)	(*0.009*)	(*0.009*)	(*0.008*)	(*0.009*)	(*0.008*)
Private control (α_1)	−0.031	−0.053	−0.016	−0.020	–	–
	(*0.031*)	(*0.040*)	(*0.032*)	(*0.028*)	–	–
Private control_30 (α_1)	–	–	–	–	−0.006	−0.003
	–	–	–	–	(*0.031*)	(*0.026*)
IRA (α_2)	−0.028	−0.157***	−0.072	−0.064*	−0.070*	−0.045
	(*0.035*)	(*0.056*)	(*0.044*)	(*0.037*)	(*0.038*)	(*0.030*)
Private control × IRA (α_3)	0.084**	0.160***	0.062[a]	0.077**	–	–
	(*0.042*)	(*0.057*)	(*0.040*)	(*0.035*)	–	–
Private control_30 × IRA (α_3)	–	–	–	–	0.069*	0.063**
	–	–	–	–	(*0.039*)	(*0.032*)

Continued

Table IV.
Continued

Market Leverage	(1) OLS	(2) OLS	(3) Fixed Effects	(4) Random Effects	(5) Fixed Effects	(6) Random Effects
Firm dummies	No	No	Yes	No	Yes	No
Country dummies	No	Yes	No	Yes	No	Yes
Sector dummies	No	Yes	No	Yes	No	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country × Sector dummies	No	Yes	No	No	No	No
P-value test on $\alpha_1 + \alpha_3 = 0$	0.001	0.036	0.273	0.090	0.148	0.071
P-value test on $\alpha_2 + \alpha_3 = 0$	0.000	0.932	0.703	0.541	0.974	0.448
R^2 within	0.273	0.473	0.273	0.257	0.274	0.255
F-test (p-value)	8.21 (0.00)	–	8.43 (0.00)	–	8.27(0.00)	
Wald-test χ^2 (p-value)	–	–	–	843.63 (0.00)	–	945.73 (0.00)
Wald-test of joint sign. of sector dummies χ^2 (p-value)				14.20 (0.027)	–	14.15 (0.028)
Wald-test of joint sign. of country dummies χ^2 (p-value)				202.50 (0.000)	–	206.55 (0.000)
Hausman test χ^2 (p-value)	–	–	–	2.49 (0.999)		9.58 (0.945)
N. Firms [N. Obs.]	92 [755]	92 [755]	92 [755]	92 [755]	92 [755]	92 [755]

[a]The p value is equal to 0.121.
The dependent variable is *Market Leverage*; it is defined as in Table III. *IRA* is a dummy equal to 1 if an IRA is in place and is equal to 0 otherwise. *Private Control* is a dummy equal to 1 when the firm is privately controlled (i.e., the government's UCR are below 50%) and is equal to 0 otherwise. *Private control_30* is a dummy equal to 1 when the state's UCR are below 30%. Standard errors in parentheses are robust to heteroschedasticity and also to within group serial correlation (observations are clustered by firms). The F-tests the null of that all coefficients are jointly equal to zero. ***, **, * denote significance at 1%, 5%, and 10%.

country- and sector-effects. In Column (4) we turn to random effects estimation that allows us to include the country and sector dummies in the estimation. In Columns (5) and (6) we examine the robustness of the results by replacing the *Private Control* dummy with the more restrictive *Private Control_30* dummy. Note that the Wald tests of the country and sector dummies in Columns (4) and (6) indicate that both dummies are jointly significant (and hence should be included in the regression), while the Hausman specification test indicates that the random effects model is valid. We therefore believe that the random effects model is more appropriate than the fixed effects model (where we cannot include country- and sector-specific dummies).

The estimates in Table IV are very similar across all specifications. The various firm-specific controls are significant and their signs are generally consistent with earlier empirical studies on the determinants of capital structure (see e.g., Rajan and Zingales, 1995). The only exception is the negative and significant coefficient on fixed-to-total assets, which is our proxy for tangibility. Earlier studies typically find that tangibility has a positive effect on leverage, the logic being that tangible assets can serve as a collateral and hence lower the cost of debt financing. In our sample, however, fixed assets are highly firm-specific and nonredeployable (e.g., roads, airports, physical electricity or telecommunications networks) and may therefore serve as poor collaterals.[23]

More importantly for us, the sum of the *Private Control* and *Private Control* $\times$ *IRA* dummies ($\alpha_1+\alpha_3$) is positive and mostly significant; the only exceptions are in Columns (3) and (5) where we use fixed effects estimates (recall though that in these regressions we cannot include country- and sector-specific dummies). These results hold both when we use the *Private Control* dummy (Columns (1)–(4)), as well as when we use the more restrictive *Private Control_30* dummy (Columns (5) and (6)).[24] The findings then provide empirical support for Hypothesis 1

23. Estimating the leverage regressions separately for the subsamples of telecoms, electric utilities, and energy utilities (electricity and natural gas), water, and transportation infrastructures (freight roads, ports, and airports), reveals that the significant negative coefficient on tangibility is due to telecoms; the coefficient is not significant for other sectors and is even positive (though not significant) for electric utilities.

24. We tested the robustness of the *Private Control_30* $\times$ *IRA* coefficient in Columns (3)–(6) to the clustering of observations by regulatory agencies (i.e., all firms regulated by the same agency are in the same cluster), and by countries (all firms that belong to the same country are in the same cluster) rather than by firms, as we do in Table IV. We found that when we cluster by regulatory agencies the interacted dummy remains significant in Columns (3) and (4), and when we cluster by countries, the *Private Control_30* $\times$ *IRA* dummy is significant in Columns (4)–(6). In addition, because there are some firm-year observations where the *Market Leverage* is zero, we also tested the baseline specification on the sub-sample of utilities with strictly positive *Market Leverage*. The resulting coefficient

and suggest that when an IRA exists, privately controlled firms have significantly higher leverage than state-controlled firms. On the other hand, the *Private Control* dummy itself is never significant (this is also true in Tables V–VII below), so absent an IRA, the leverage of privately controlled firms is not significantly different than the leverage of state-controlled firms.

Table IV also shows that the sum of the *IRA* and *Private Control* × *IRA* dummies ($\alpha_2 + \alpha_3$) is not significant: in and of itself, the existence of an IRA does not have a significant effect on the leverage of privately controlled regulated firms. By contrast, the *IRA* dummy is negative and in some cases significant; this provides weak support for the hypothesis that state-controlled firms have a lower leverage in the presence of an IRA. Table VII below shows that this is mainly due to firms that were state-controlled throughout our sample.

In Table V we add the *Political Orientation* and *Investor Protection* variables to our core specification to control for institutional factors.[25] Columns (1) and (2) use the *Private Control* dummy, while Columns (3) and (4) use the more restrictive *Private Control_30* dummy. Columns (1) and (3) show that the *Political Orientation* variable, which reflects how right wing the government is, is negative and significant under both definitions of private control. If we think of right-wing governments as being more pro-firm, then this result suggests that firms facing more pro-firm governments do not need to rely on high leverage to obtain favorable regulatory outcomes as much as firms facing pro-consumer governments. On the other hand, Columns (2) and (4) show, as expected, that stronger investor protection is associated with lower leverage, presumably because it lowers the cost of equity financing. Like Table IV, the results in Table V also provide empirical support for Hypothesis 1 as the sum of the *Private control* and *Private control* × *IRA* dummies ($\alpha_1 + \alpha_3$) is once again positive and significant across all specifications. Moreover, in Columns (1) and (3), the sum of the *IRA* and *Private control* × *IRA* dummies ($\alpha_2 + \alpha_3$) is positive and significant. This suggests that once we control for investor protection, privately controlled firms have significantly higher leverage when they are subject to regulation by an IRA.

One might argue that the results in Table V are at least partly driven by exogenous fluctuations in equity markets which affect the

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on the *Private Control* × *IRA* dummy is 0.081(the *p*-value is 0.02) and the coefficient on the *Private Control_30* × *IRA* dummy is 0.064 (the *p*-value is 0.04).

25. We do not include the two variables in the same regression because then the Hausman specification test rejects the random effects model. As mentioned above, we prefer to use the random effects model because we cannot include country- and sector-specific dummies in fixed effects estimation.

Table V.
Leverage, Regulation, Ownership and Institutional Environment

Market Leverage	(1)	(2)	(3)	(4)
Log of real total assets	0.033***	0.034***	0.032***	0.032***
	(*0.009*)	(*0.009*)	(*0.009*)	(*0.009*)
Fixed-to-total assets	−0.131**	−0.105**	−0.122**	−0.094*
	(*0.052*)	(*0.051*)	(*0.055*)	(*0.054*)
EBIT-to-total assets	−0.317***	−0.315***	−0.326***	−0.322***
	(*0.079*)	(*0.080*)	(*0.080*)	(*0.080*)
Nondebt tax shield	−1.259***	−1.284***	−1.272***	−1.302***
	(*0.374*)	(*0.329*)	(*0.378*)	(*0.329*)
GDP growth	−0.029***	−0.032***	−0.029***	−0.032***
	(*0.008*)	(*0.008*)	(*0.008*)	(*0.008*)
Political orientation	−0.015**	–	−0.014**	–
	(*0.007*)	–	(*0.007*)	–
Investor protection	–	−0.036**	–	−0.036**
	–	(*0.016*)	–	(*0.015*)
Private Control (α_1)	0.002	0.001	–	–
	(*0.028*)	(*0.028*)	–	–
Private Control_30 (α_1)	–	–	−0.011	0.012
	–	–	(*0.026*)	(*0.024*)
IRA (α_2)	−0.028	−0.044	−0.013	−0.030
	(*0.038*)	(*0.036*)	(*0.033*)	(*0.029*)
Private Control × IRA (α_3)	0.067**	0.056*	–	–
	(*0.033*)	(*0.033*)	–	–
Private Control_30 × IRA (α_3)	–	–	0.051*	0.043[a]
			(*0.030*)	(*0.030*)
Sector dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
P-value test on $\alpha_1 + \alpha_3 = 0$	0.035	0.074	0.046	0.069
P-value test on $\alpha_2 + \alpha_3 = 0$	0.094	0.564	0.096	0.577
R^2 within	0.269	0.279	0.266	0.277
Wald-test χ^2 (*p*-value)	1144.25 (0.00)	770.25 (0.00)	1248.14 (0.00)	856.45 (0.00)
Hausman test χ^2 (*p*-value)	18.31 (0.502)	14.38 (0.811)	19.90 (0.464)	95.97 (0.00)
N. Firms [N. Obs.]	92 [755]	92 [755]	92 [755]	92 [755]

[a]The *p* value is equal to 0.154.
The dependent variable is *Market Leverage*; it is defined as in Table III. *Private control_30* is a dummy equal to 1 when the state's UCR are below 30%. *Political Orientation* ranges from 0 (extreme left wing) to 10 (extreme right wing) and is equal to a weighted average of scores given in expert surveys supporting government (see Huber and Inglehart, 1995, and Bortolotti and Faccio, 2008). *Investor Protection* is the time-varying "antidirector rights" index by Pagano and Volpin (2005). All regressions include year, sector and country dummies. Random-effects estimates. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation (observations are clustered by firms). The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of nonsystematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5%, and 10%.

Table VI.
Robustness: Book Leverage Regressions

Book Leverage	(1)	(2)	(3)	(4)
Log of real total assets	0.035***	0.033***	0.034***	0.034***
	(*0.011*)	(*0.010*)	(*0.010*)	(*0.011*)
Fixed-to-total assets	−0.264***	−0.264***	−0.252***	−0.260***
	(*0.077*)	(*0.076*)	(*0.075*)	(*0.076*)
EBIT-to-total assets	−0.332***	−0.326***	−0.327***	−0.341***
	(*0.097*)	(*0.097*)	(*0.098*)	(*0.097*)
Nondebt tax shield	−0.900**	−0.936**	−0.951**	−0.887**
	(*0.453*)	(*0.450*)	(*0.430*)	(*0.454*)
GDP growth	−0.021**	−0.022**	−0.022**	−0.021**
	(*0.010*)	(*0.010*)	(*0.010*)	(*0.010*)
Political orientation	–	−0.012*	–	–
	–	(*0.07*)	–	–
Investor protection	–	–	−0.018	–
	–	–	(*0.013*)	–
Private control (α_1)	−0.047	−0.034	−0.038	–
	(*0.031*)	(*0.032*)	(*0.033*)	–
Private control_30 (α_1)	–	–	–	−0.052
	–	–	–	(*0.034*)
IRA (α_2)	−0.102***	−0.085**	−0.098***	−0.092***
	(*0.034*)	(*0.036*)	(*0.035*)	(*0.030*)
Private control × IRA (α_3)	0.115***	0.114***	0.108***	–
	(*0.038*)	(*0.038*)	(*0.038*)	–
Private control_30 × IRA (α_3)	–	–	–	0.126***
	–	–	–	(*0.037*)
Sector dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
P-value test on $\alpha_1 + \alpha_3 = 0$	0.052	0.021	0.045	0.013
P-value test on $\alpha_2 + \alpha_3 = 0$	0.648	0.312	0.731	0.282
R^2 within	0.201	0.208	0.206	0.201
Wald-test χ^2 (p-value)	906.21 (0.00)	1210.2 (0.00)	995.71 (0.00)	933.78 (0.00)
Hausman test χ^2 (p-value)	0.93 (1.000)	7.44 (0.995)	12.90 (0.882)	6.12 (0.998)
N. Firms [N. Obs.]	92 [869]	92 [869]	92 [869]	92 [869]

The dependent variable is *Book Leverage*, which is total financial debt divided by the sum of total financial debt and the book value of equity. The explanatory variables are defined similarly to Table IV. All regressions include year, sector, and country dummies. Random-effects estimates. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation (observations are clustered by firms). The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of nonsystematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5%, and 10%.

market leverage of firms for reasons that have nothing to do with our hypotheses. To address this concern, we re-estimate our core specification in Table VI, using *Book Leverage* (the ratio between total financial debt and the sum of total financial debt and the book value of equity) as our measure of leverage. The sample size is now larger than

Table VII.
The Effect of Ownership Structure on Market Leverage

Market Leverage	(1) Privatized Utilities	(2) Privatized Utilities	(3) Privatized Utilities	(4) Privately Controlled Throughout the Period	(4) State-Controlled Throughout the Period
Log of real total assets	0.040***	0.040***	0.042***	0.022*	0.039***
	(*0.010*)	(*0.010*)	(*0.010*)	(*0.013*)	(*0.013*)
Fixed-to-total assets	−0.078	−0.075	−0.110*	−0.152***	0.191
	(*0.060*)	(*0.063*)	(*0.063*)	(*0.055*)	(*0.150*)
EBIT-to-total assets	−0.934***	−0.929***	−0.879***	−0.370***	0.187***
	(*0.208*)	(*0.207*)	(*0.209*)	(*0.041*)	(*0.044*)
Nondebt tax shield	−2.153***	−2.151***	−2.439***	−1.037**	−2.354***
	(*0.481*)	(*0.485*)	(*0.475*)	(*0.522*)	(*0.854*)
GDP growth	−0.025**	−0.025**	−0.027**	−0.027	−0.027***
	(*0.011*)	(*0.012*)	(*0.011*)	(*0.017*)	(*0.009*)
Political orientation	−0.006	−0.006	−0.005	−0.027***	−0.019
	(*0.017*)	(*0.017*)	(*0.018*)	(*0.009*)	(*0.013*)
Private control (α_1)	0.007	−0.000	−0.018	–	–
	(*0.038*)	(*0.033*)	(*0.038*)	–	–
IRA (α_2)	0.080*	0.067	0.090*	0.067*	−0.260***
	0.045	(*0.050*)	(*0.047*)	(*0.037*)	(*0.055*)
Private control × IRA (α_3)	–	0.016	0.069*	–	–
	–	(*0.043*)	(*0.041*)	–	–

Continued

Table VII.
Continued

Market Leverage	(1) Privatized Utilities	(2) Privatized Utilities	(3) Privatized Utilities	(4) Privately Controlled Throughout the Period	(4) State-Controlled Throughout the Period
Golden shares (α_4)	–	–	0.066	–	–
	–	–	*(0.069)*	–	–
Golden shares × IRA (α_5)	–	–	−0.130*	–	–
		–	*(0.078)*	–	–
Sector dummies	Yes	Yes	Yes	Yes	
Country dummies	Yes	Yes	Yes	Yes	
Year dummies	Yes	Yes	Yes	Yes	
Year × Private/State dummies	No	No	No	Yes	
Sector × Private/State dummies	No	No	No	Yes	
P-value test on $\alpha_1 + \alpha_3 = 0$		0.770	0.312		
P-value test on $\alpha_1 + \alpha_3 + \alpha_4 + \alpha_5 = 0$			0.903		
P-value test on $\alpha_1 + \alpha_4 = 0$			0.443		
P-value test on $\alpha_4 + \alpha_5 = 0$			0.189		
P-value test on $\alpha_2 + \alpha_3 = 0$		0.084	0.000		
P-value test on $\alpha_2 + \alpha_3 + \alpha_5 = 0$			0.658		
R^2 within	0.445	0.445	0.447	0.257	
Wald-test χ^2 (*p*-value)	10800 (0.00)	2225 (0.00)	5234.86 (0.00)	46843.71 (0.00)	
Hausman test χ^2 (*p*-value)	17.31(0.502)	7.57 (0.991)	12.90 (0.912)	13.90 (0.999)	
N. Firms [N. Obs.]	25[195]	25 [195]	25 [195]	66 [552]	

Variables are defined similarly to Table IV. Columns (1)–(3) examine a subsample of firms that were privatized (i.e., the state's UCR went below 50%) during our sample period. We observe these firms before and after privatization. *Golden Shares* is a dummy equal to 1 when golden shares are in place and equals 0 otherwise. Column (4) reports results for the subsample of utilities that remained either privately- or state-controlled throughout our sample period. All regressions include year, sector, and country dummies. In Column (4) the sector and the year dummies are also interacted with the *Private Control* and the *State Control* dummies (the *State Control* dummy is defined as 1-*Private Control*). Random effects estimates. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation (observations are clustered by firms). The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of nonsystematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5%, and 10%.

in Tables IV and V because we have more observations on book leverage than on market leverage. As one can see, the results are very similar to those in Tables IV and V. In particular, the sum of the *Private control* and *Private control* × *IRA* dummies ($\alpha_1 + \alpha_3$) is once again positive and significant across all estimations. It therefore appears that the positive effect of private-control on the leverage of firms that are regulated by an IRA is robust to the measure of leverage that we use.[26]

In Table VII we look more closely at the effect of ownership on leverage. To this end, we separate the firms in our sample into two subsamples. Columns (1)–(3) examine firms that were privatized during our sample period (i.e., the government's UCR in the firm dropped below 50% during our sample period). Here, the *Private control* dummy captures the difference in leverage before and after privatization. Column (4) examines, separately, firms that stayed either privately- or state-controlled throughout our sample period (i.e., the government's UCR in the firm remained either below or above 50% throughout our sample period). This allows us to estimate the impact of IRA after controlling for the effect of ownership on leverage through other regressors.

Column (1) in Table VII shows that, in and of itself, privatization does not have a significant effect on the leverage of regulated firms, but regulatory independence does: the coefficient of the *Private Control* dummy is not significant while the coefficient of the *IRA* dummy is positive and significant.[27] Column (2) adds the *Private Control* × *IRA* dummy and shows that neither the *Private Control* dummy nor the sum of the *Private Control* and the *Private Control* × *IRA* dummies ($\alpha_1 + \alpha_3$) are significant.[28] On the other hand, the sum of the *IRA* and *Private Control* × *IRA* dummies ($\alpha_2 + \alpha_3$) is positive and significant, indicating that the leverage of privatized firms is significantly larger when they are subject to regulation by an IRA.[29]

26. To further control for equity market fluctuations, we also added to the regression country-specific stock market indices. These indices however had no significant effect on our results.

27. If we add *Private Control* and *IRA* separately, the results do not change: *Private Control* remains insignificant even if the absence of the *IRA* dummy, while *IRA* remains significant even after the *Private Control* dummy is removed (its coefficient equals 0.079 with a *p*-value of 0.08).

28. We also added a *Privatization Year* dummy that is equal to 1 in the year of privatization and is equal to 0 in all other years, but this dummy was not significant.

29. The lack of a privatization effect on leverage is in contrast to Dewenter and Malatesta (2001), Megginson, Nash, and Van Radenborgh (1994), and D'Souza and Megginson (1999). They study privatizations in different countries, sectors, and time periods, and show that in most cases, firms lower their leverage following privatization and this decrease can often be substantial. Unlike our paper, though, these papers do not focus on regulated firms. Moreover, many of the regulated utilities in their samples were not regulated by IRAs.

As mentioned in Section 4.2, 11 privately controlled firms in our sample have golden shares that give the state special control rights. Firms with golden shares may not act like private firms even if the government's UCR is small. In Column (3) in Table VII we control for the existence of golden share by including *Golden Share* and *Golden Share* $\times$ *IRA* dummies in the regression (the *Golden Share* dummy is equal to 1 in all years in which the firm had golden shares and is equal to 0 otherwise). Once the *Golden Share* and *Golden Share* $\times$ *IRA* dummies are included in the regression, the value of the intercept in equation (1), depending on the firm's ownership and regulatory structures, becomes

	IRA	No IRA	IRA effect
Privately controlled without golden shares	$\alpha_0+\alpha_1+\alpha_2+\alpha_3$	$\alpha_0+\alpha_1$	$\alpha_2+\alpha_3$
Privately controlled with golden shares	$\alpha_0+\alpha_1+\alpha_2+\alpha_3+\alpha_4+\alpha_5$	$\alpha_0+\alpha_1+\alpha_4$	$\alpha_2+\alpha_3+\alpha_5$
State-controlled	$\alpha_0+\alpha_2$	α_0	α_2
Ownership effect without golden shares	$\alpha_1+\alpha_3$	α_1	
Ownership effect with golden shares	$\alpha_1+\alpha_3+\alpha_4+\alpha_5$	$\alpha_1+\alpha_4$	
Golden shares effect for Privately controlled firms	$\alpha_4+\alpha_5$	α_4	

For example, the value of $\alpha_1 + \alpha_3$ captures the effect of private-control without golden shares if an IRA exists and the value of α_1 captures the effect if an IRA does not exist.

The results are very similar to those in Column (1) of Table VII: privatization still does not have a significant effect on leverage irrespective of whether firms have golden shares or not and whether or not an IRA exists (both α_1, $\alpha_1 + \alpha_3$, $\alpha_1 + \alpha_4$, and $\alpha_1 + \alpha_3 + \alpha_4 + \alpha_5$ are not significant). As in Column (1), the existence of IRA does have a positive and significant effect on leverage, but only if firms are privately controlled and do not have golden shares or if they are state-controlled ($\alpha_2 + \alpha_3$ and α_2 are positive and significant). When firms are privately controlled and have golden shares, IRA does not have a significant effect on the leverage. The results also show that in and of themselves, golden shares do not have a significant effect on leverage as both α_4 and $\alpha_4 + \alpha_5$ are not significant.

Column (4) in Table VII examines the differences between firms that stayed privately- or state-controlled throughout our sample period (i.e., were not involved in a "privatization" process). The results show that there are several important differences between firms that are

privately- or state-controlled throughout our sample period. First, tangibility (*Fixed-to-Total Assets*) has a significantly negative coefficient for privately controlled firms, but not for state-controlled firms; this difference is probably due to the fact that telecoms are heavily represented in the group of privately controlled firms (see Footnote 23 above). Second, the measure of profitability (*EBIT-to-Total Assets*) has a significant negative effect in the case of privately controlled firms, which is consistent with the typical findings in the empirical corporate finance literature, but has a significant positive effect in the case of state-controlled firms. Third, the *GDP Growth* coefficient is significant only in the case of state-controlled firms, but not in the case of privately controlled firms. Fourth, the *Political Orientation* variable is not significant in the case of state-controlled firms, but is negative and significant in the case of privately controlled firms. Because an increase in the *Political Orientation* variable indicates that the government is more right-wing and hence likely to be more pro-firm, the latter result suggests that when privately controlled firms face a more pro-firm government, they do not need to rely on high leverage to obtain favorable regulatory outcomes. The fact that the leverage of state-controlled firms is not affected by the political orientation variable is consistent with the theory because state-controlled firms do not need to issue debt to shield themselves from regulatory opportunism. Finally, the IRA variable is positive and significant in the case of privately controlled firms, which is consistent with Hypothesis 1, and is negative and highly significant in the case of state-controlled firms. The latter result, together with the fact that Column (1) shows that the IRA variable is positive in the case of privatized firms, suggests that the negative coefficient of the IRA variable in Table IV is driven by firms that were state-controlled throughout our sample.

5.2 Leverage and Regulated Prices

Next, we consider Hypothesis 2, which states that higher leverage induces regulators to raise regulated prices provided that the firm is privately controlled. When the firm is state-controlled, the state plays a dual role of an owner and a regulator and hence the firm does not need to use its leverage as a way to induce higher regulated prices.

To test Hypothesis 2, we apply the Granger (1969) and Sims (1972) causality tests to examine whether leverage Granger-causes regulated prices. That is, we examine whether an increase in leverage is followed by an increase in regulated prices, but not vice versa.[30] There are

30. See Arellano (2003, Ch. 6) for details regarding the use Granger causality tests in the context of a panel setting and an application to panel data with a relatively short time horizon from 1983 to 1990 (our panel data covers a longer period: 1994–2005).

three alternative possibilities. First, if regulators can make a long-term commitment to regulated prices, then regulated prices will determine the firm's revenues (up to some exogenous demand shocks), and the firm in turn would adjust its capital structure to match its expected revenue stream. In that case, regulated prices would Granger-cause leverage. Second, it could be that leverage and regulated prices are correlated but neither one Granger causes the other; rather the two variables are correlated with a third variable that causes both of them. A third possibility is that leverage and regulated prices are simply not correlated with one another.

We perform the Granger tests by estimating the following bivariate VAR(2) model for sector- and country-specific retail price indices and leverage:

$$P_{it} = \alpha^P_{t-1} P_{i,t-1} + \alpha^P_{t-2} P_{i,t-2} + \beta^P_{t-1} L_{i,t-1} + \beta^P_{t-2} L_{i,t-2} + \sum_i \mu^P_i Firm_i + \sum_t \lambda^P_t Year_t + \varepsilon^P_{it}, \quad (2)$$

$$L_{it} = \alpha^L_{t-1} P_{i,t-1} + \alpha^L_{t-2} P_{i,t-2} + \beta^L_{t-1} L_{i,t-1} + \beta^L_{t-2} L_{i,t-2} + \sum_i \mu^L_i Firm_i + \sum_t \lambda^L_t Year_t + \varepsilon^L_{it}, \quad (3)$$

where P_{it} and L_{it} are the regulated price and market leverage of firm i in period t, $Firm_i$ and $Year_t$ are firm and year dummies, and ${\varepsilon^P}_{it}$ and ${\varepsilon^L}_{it}$ are error terms. Our hypothesis that, conditional on individual and time effects, leverage Granger-causes regulated prices, but not vice versa, requires that β^P_{t-1} and β^P_{t-2} are positive and significant, while α^L_{t-1} and α^L_{t-2} are not significant. Moreover, it requires that $L_{i,t-1}$ and $L_{i,t-2}$ contribute significantly to the explanatory power of regression (2), while $P_{i,t-1}$ and $P_{i,t-2}$ do not contribute significantly to the explanatory power of equation (3). We expect these results to hold in the case of privately controlled firms, but not in the case of state-controlled firms.

A main concern when estimating a dynamic model as in equations (2) and (3) is that the lagged dependent variables are endogenous to the

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Granger causality tests were recently used in a similar context to study the causal relationship between the intensity of product market regulation (reflected by various indicators of barriers to entry, state ownership, market share of entrants, and price controls), and investments in 21 OECD countries from 1975 to 1996 (Alesina et al., 2005), interconnection rates and regulatory independence in the EU-15 member states from 1997 to 2003 (Edwards and Waverman, 2006), political accountability and various performance measures in telecommunications in 52 developed and developing countries from 1985 to 1999 (Gasmi, Noumba, and Recuero Virto, 2006), and telecommunications reforms and network expansion in developing countries from 1985 to 1999 (Gasmi and Recuero Virto, 2008).

fixed effects in the error term, thus giving rise to a dynamic panel bias. To deal with this bias and with the potential endogeneity of other regressors in the leverage equation, we use the Arellano and Bond (1991) and Arellano and Bover (1995) linear generalized method of moments (GMM) estimators. More specifically, we use the dynamic System-GMM model developed by Arellano and Bond (1991) and Blundell and Bond (1998). This model estimates a system of level and first-differenced equations and uses lags of first-differenced variables as instruments for equations in levels and lags of variables in levels as instruments for equations in first-differences.[31] For the validity of the GMM estimates it is crucial, however, that the instruments are exogenous. We therefore calculate the two-step Sargan-Hansen statistic under the null of joint validity of the instruments and report the resulting p-values with the regression results. To ensure that the lagged variables are valid instruments, we use the Arellano and Bond (1991) autocorrelation test control for AR(1) and AR(2). Because AR(2) was detected, we restrict the lags instrumenting the lagged leverage to $t-3$ and $t-4$.

Tables VIII and IX report the results from estimating equations (2) and (3). In both tables, we examine the full sample in Column (1), and several subsamples in Columns (2)–(7). Table VIII shows that with the exception of firms which are not regulated by an IRA (Column (3)), or are state-controlled (Column (7)), the second lag of market leverage has a significant positive effect on regulated prices. Moreover, a Wald statistic test indicates that the first and second lags of market leverage are jointly significantly. On the other hand, Table IX shows that the lagged regulated prices do not have significant effect on leverage either individually or jointly. Together, these results imply that, so long as firms are privately controlled and/or regulated by an IRA, leverage Granger-causes regulated prices, but not vice versa. These results are consistent with the hypothesis that regulated firms which are either privately controlled or regulated by an IRA (or both), choose their leverage strategically in order to induce regulators to set higher prices, and inconsistent with the alternative hypotheses that long-term regulatory commitments to prices induce firms to adjust their capital structure to match their resulting expected revenue stream, or that leverage and regulated prices are driven by a third variable that causes both of them. The results are also inconsistent with the hypothesis that regulated prices increase when the firm issues more equity, say because regulators base prices on the firm's WACC that is in turn decreasing with the firm's leverage.

31. For estimation we used the xtabond2 Stata command created by David Roodman (2006).

Table VIII.
Regulated Price Equations—Granger Tests

Utility Price	(1) Full Sample	(2) IRA Exists	(3) IRA Does Not Exist	(4) Privately Controlled (50%)	(5) Privately Controlled (30%)	(6) Privately Controlled Throughout our Sample	(7) State-Controlled
α^{P}_{1} Utility Price$_{t-1}$	0.759***	0.694***	0.738***	0.787***	0.807***	0.736***	0.821***
	(*0.083*)	(*0.073*)	(*0.200*)	(*0.074*)	(*0.065*)	(*0.100*)	(*0.134*)
α^{P}_{2} Utility Price$_{t-2}$	0.183*	0.289**	0.078	0.161*	0.129	0.176	0.025
	(*0.103*)	(*0.109*)	(*0.180*)	(*0.092*)	(*0.085*)	(*0.132*)	(*0.118*)
β^{P}_{1} Market Leverage$_{t-1}$	−0.052	0.021	−0.013	−0.019	−0.049	−0.130	0.040
	(*0.053*)	(*0.057*)	(*0.021*)	(*0.038*)	(*0.042*)	(*0.097*)	(*0.065*)
β^{P}_{2} Market Leverage$_{t-2}$	0.154***	0.192***	−0.004	0.154***	0.153***	0.266**	0.001
	(*0.057*)	(*0.064*)	(*0.017*)	(*0.055*)	(*0.054*)	(*0.102*)	(*0.045*)
P-value test on H_0: $\beta^{P}_{1} = \beta^{P}{}_{2} = 0$	*0.025*	*0.012*	*0.679*	*0.024*	*0.024*	*0.038*	*0.604*
P-value test on H_0: $\beta^{P}_{1} + \beta^{P}{}_{2} = 0$	*0.048*	*0.011*	*0.388*	*0.023*	*0.050*	*0.095*	*0.327*
Arellano-Bond test for AR(1) *(p-value)*	*0.000*	*0.000*	*0.10*	*0.000*	*0.000*	*0.008*	*0.031*
Arellano-Bond test for AR(2) *(p-value)*	*0.898*	*0.087*	*0.17*	*0.475*	*0.235*	*0.537*	*0.764*
Sargan-Hansen test *(p-value)*	*0.191*	*0.358*	0.994	*0.264*	*0.839*	*0.523*	*0.964*
N. Firms [N. Obs.]	74 [482]	58 [350]	26[132]	57 [362]	44 [296]	37 [276]	30 [120]
Instruments	$t-3; t-4; \Delta t-2$	$t-3; t-4; \Delta t-2$	$t-3; \Delta t-2$	$t-3; t-4; \Delta t-2$	$t-3; t-4; \Delta t-2$	$t-3; \Delta t-2$	$t-2; \Delta t-1$

The dependent variable in Table VIII is the country-sector-specific utility price index (see Section 3). The dependent variable in Table IX is *Market Leverage*. Column (3) focuses on firms that are subject to regulation by an IRA (telecom, energy, and water supply firms in the U.K.) (see Gilardi, 2002). Dynamic panel-data estimation, one-step system GMM estimates. Lagged values of Market Leverage and Utility Price used as instruments: lagged levels are used in first-differences equations and lags of first-differenced variables are used in levels equations (see last row). All regressions include year dummies. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation (observations are clustered by firms). AR(1) tests the null hypothesis of no first-order correlation in the differenced residuals (Arellano-Bond test is still valid if differenced errors are AR(1)). AR(2) tests the null hypothesis of no second-order correlation in the differenced residuals (Arellano-Bond test is not valid if differenced errors are AR(2)). The Sargan-Hansen statistic tests the null hypothesis that the over-identifying restrictions are valid. ***, **, * denote significance of the coefficients at 1%, 5%, and 10%.

Table IX.
Leverage Equations—Granger Tests

Market Leverage	(1) Full Sample	(2) IRA Exists	(3) IRA Does not Exist	(4) Privately Controlled (50%)	(5) Privately Controlled (30%)	(6) Privately Controlled Throughout our Sample	(7) State-Controlled
α^{I}_{1} Utility Price$_{t-1}$	−0.205	−0.166	−0.008	−0.082	−0.233	−0.145	0.154
	(*0.192*)	(*0.188*)	(*0.012*)	(*0.197*)	(*0.177*)	(*0.188*)	(*0.263*)
α^{I}_{2} Utility Price$_{t-2}$	0.326	0.160	0.011	0.070	0.252	0.017	−0.183
	(*0.230*)	(*0.236*)	(*0.011*)	(*0.200*)	(*0.223*)	(*0.142*)	(*0.218*)
β^{I}_{1} Market Leverage$_{t-1}$	0.390**	0.191	0.423***	0.367*	0.292	0.332	0.546***
	(*0.187*)	(*0.210*)	(*0.142*)	(*0.219*)	(*0.203*)	(*0.250*)	(*0.151*)
β^{I}_{2} Market Leverage$_{t-2}$	0.135	0.168	0.102	0.265	0.205	−0.067	0.065
	(*0.143*)	(*0.154*)	(*0.206*)	(*0.187*)	(*0.156*)	(*0.224*)	(*0.137*)
P-value test on $\alpha^{I}_{1} = \alpha^{I}_{2} = 0$	*0.364*	*0.639*	*0.193*	*0.912*	*0.374*	*0.718*	*0.674*
Arellano-Bond test for AR(1) *(p-value)*	*0.022*	*0.083*	*0.103*	*0.090*	*0.024*	*0.016*	*0.078*
Arellano-Bond test for AR(2) *(p-value)*	*0.275*	*0.153*	*0.126*	*0.138*	*0.250*	*0.817*	*0.109*
Sargan-Hansen test *(p-value)*	*0.126*	*0.306*	*0.996*	*0.179*	*0.821*	*0.700*	*1.000*
N. Firms [N. Obs.]	74 [479]	58 [348]	26[131]	57 [360]	44 [294]	37 [274]	30 [119]
Instruments	$t-3; t-4; \Delta\, t-2\ t-3; t-4; \Delta\, t-2\ t-3; \Delta\, t-2\ t-3; t-4; \Delta\, t-2\ t-3; t-4; \Delta\, t-2$					$t-2; \Delta\, t-1$	$t-2; \Delta$ t − 1

6. The Subsample of Energy Utilities

So far our analysis was based on a diverse set of firms operating in a wide array of industries. Although all of our regressions include sector specific dummies, one may worry that the large heterogeneity of firms in our sample and the fact that they are subject to different regulatory environments biases our results in some way. To address this concern we now reestimate our main specifications using a subsample of energy utilities (gas and electricity). This group of firms is the largest in our sample and comprises of 44 utilities and 354 firm-year observations (46% of our full sample). Firms in this subsample are all regulated by energy regulatory agencies and are subject to the same EU directives, described in Section 2, which member states were required to transpose into national legislation. It should also be noted that the "dash for debt" concern was raised mainly in the context of energy utilities (see AEEG, 2007; Ofgem, 2008).

In Table X, we reestimate our baseline specification for the leverage equation using random effects estimation. The main difference between the results in Tables IV–VII, and X is that the coefficients of the *IRA* and the *Private Control* × *IRA* dummies are larger in absolute values and more significant than in Section 5. Moreover, Column (1) in Table X shows that as in Tables IV–VII, the coefficient of the *Private Control* dummy is insignificant while the sum of the coefficients of the *Private Control* and *Private Control* × *IRA* dummies ($\alpha_1 + \alpha_3$) is positive and significant. This result is coefficient with Hypothesis 1 because it implies that privately controlled regulated firms have a higher leverage than state-control firms provided that they are regulated by an IRA. Columns (2)–(4) show that this conclusion is not altered when Golden Shares are taken into account, when we restrict attention only to firms that were privatized during our sample period, and when we replace the *Private Control* dummy with the *Private Control_30* dummy.

Table XI presents the results of our Granger tests regarding the interaction between leverage and regulated rates for the subsample of energy utilities. Columns (1), (3), (5), and (7) report the results from estimating equation (2), while Columns (2), (4), (6), and (8) report the results from estimating equation (3). The results are very similar to those in Tables VIII and IX: the coefficients of the lagged leverage terms in the price equation are jointly significant and so is their sum for the full sample and the subsamples of privately controlled firms and firms that are regulated by an IRA, but not for state-controlled firms.[32] By contrast, the coefficients of the lagged prices are insignificant in

32. Unfortunately, we have only 52 firm-year observations on energy utilities without an IRA and hence were unable to run Granger causality tests for this subsample of firms.

Table X.
Leverage, Regulation and Ownership: Energy Utilities

Market Leverage	(1) Full Sample	(2) Full Sample	(3) Privatized Utilities	(4) Full Sample
Log of real total assets	0.032***	0.033***	0.034***	0.035**
	(*0.012*)	(*0.012*)	(*0.012*)	(*0.014*)
Fixed-to-total assets	−0.024	−0.025	0.010	0.004
	(*0.097*)	(*0.094*)	(*0.127*)	(*0.098*)
EBIT-to-total assets	−0.445***	−0.443***	−0.486***	−0.444***
	(*0.054*)	(*0.054*)	(*0.062*)	(*0.060*)
Nondebt tax shield	−2.935***	−2.943***	−3.540***	−2.953***
	(*0.725*)	(*0.723*)	(*0.770*)	(*0.744*)
GDP growth	−0.019	−0.020	−0.019	−0.025*
	(*0.015*)	(*0.015*)	(*0.019*)	(*0.014*)
Private control (α_1)	−0.012	−0.021	−0.059	–
	(*0.057*)	(*0.057*)	(*0.075*)	–
Private control_30 (α_1)	–	–	–	0.041
	–	–	–	(*0.049*)
IRA (α_2)	−0.134***	−0.140***	−0.156***	−0.119***
	(*0.045*)	(*0.045*)	(*0.050*)	(*0.035*)
Private control × IRA (α_3)	0.101**	0.110**	0.159***	–
	(*0.049*)	(*0.050*)	(*0.061*)	–
Private control_30 × IRA (α_3)	–	–	–	0.094**
	–	–	–	(*0.045*)
Golden shares (α_4)	–	−0.082*	−0.115**	−0.055
	–	(*0.050*)	(*0.049*)	(*0.057*)
Year dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
P-value test on $\alpha_1 + \alpha_3 = 0$	0.019	0.018	0.026	0.002
P-value test on $\alpha_2 + \alpha_3 = 0$	0.381	0.425	0.965	0.562
R^2 within	0.322	0.320	0.338	0.337
Wald-test $\chi 2$ (p-value)	494.36 (0.00)	216.36 (0.00)	360.08 (0.00)	418.58 (0.00)
Hausman test $\chi 2$ (*p*-value)	1.52 (1.00)	8.42 (0.98)	6.11 (0.10)	11.08 (0.92)
N. Firms [N. Obs.]	44 [354]	44 [354]	33 [280]	44 [354]

The dependent variable, *Market Leverage*, and the regressors are all defined as in Tables III, IV–VII. Column (3), reports the results for the subsample of energy utilities that were privatised during the period. All regressions include year and country dummies. Random-effects estimates with robust standard errors. The Wald χ^2 tests the null of that all coefficients are jointly equal to zero. The Hausman χ^2 tests the null of nonsystematic differences of the fixed and random effects model. ***, **, * denote significance at 1%, 5%, and 10%. ***, **, * denote significance at 1%, 5%, and 10%.

the leverage equation. These results are consistent with Hypothesis 2 that regulated prices increase when firms become more highly leveraged.

Table XI.
Regulated Prices and Leverage of Energy Utilities—Granger Tests

	Full Sample		Privately Controlled (50%)		State-Controlled		IRA in Place	
	(1) *Utility Price*	*(2)* *Market Leverage*	*(3)* *Utility Price*	*(4)* *Market Leverage*	*(5)* *Utility Price*	*(6)* *Market Leverage*	*(7)* *Utility Price*	*(8)* *Market Leverage*
α_1 Utility Price$_{t-1}$	0.732***	−0.031	0.823***	−0.047	0.653***	0.158	0.607***	−0.358
	(*0.094*)	(*0.128*)	(*0.083*)	(*0.113*)	(*0.092*)	(*0.520*)	(*0.066*)	(*0.137*)
α_2 Utility Price$_{t-2}$	0.272**	0.065	0.170*	0.153	0.160*	−0.244	0.317***	0.155
	(*0.108*)	(*0.205*)	(*0.090*)	(*0.191*)	(*0.082*)	(*0.355*)	(*0.076*)	(*0.208*)
β_1 Leverage$_{t-1}$	−0.102	0.426***	−0.109	0.613***	−0.058	0.510**	−0.066	0.410***
	(*0.064*)	(*0.104*)	(*0.067*)	(*0.129*)	(*0.074*)	(*0.202*)	(*0.061*)	(*0.091*)
β_2 Leverage$_{t-2}$	0.196***	0.222	0.245***	0.160	−0.010	0.292	0.146***	0.268
	(*0.060*)	(*0.166*)	(*0.062*)	(*0.157*)	(*0.060*)	(*0.206*)	(*0.049*)	(*0.193*)
P-value test on H$_0$: $\beta_1 = \beta_2 = 0$	*0.066*	*0.867*	*0.053*	*0.723*	*0.293*	*0.766*	*0.010*	*0.757*
P-value test on H$_0$: $\beta_1 + \beta_2 = 0$	*0.007*	*0.942*	*0.002*	*0.554*	*0.125*	*0.817*	*0.128*	*0.579*
Arellano-Bond test for AR(1) *(p-value)*	*0.001*	*0.030*	*0.000*	*0.010*	*0.004*	*0.065*	*0.000*	*0.092*
Arellano-Bond test for AR(2) *(p-value)*	*0.469*	*0.067*	*0.856*	*0.150*	*0.262*	*0.171*	*0.147*	*0.061*
Sargan-Hansen test *(p-value)*	*0.391*	*0.458*	*0.988*	*0.987*	*1.000*	*1.000*	*0.642*	*0.680*
N. Firms [N. Obs.]	41 [279]	41 [278]	30 [201]	30 [200]	19 [78]	19 [78]	37 [227]	37 [226]
Instruments	$t-3$; $\Delta t-2$	$t-3$; $\Delta t-2$	$t-3$; $\Delta t-2$	$t-3$; $\Delta t-2$	$t-3$; $\Delta t-2$	$t-3$; $\Delta t-2$	t−3; Δt−2	t−3; Δt−2

The dependent variables in Columns (1), (3), and (5) is the country-sector-specific utility price index. The dependent variable in Columns (2), (4) and (6) is *Market Leverage*. Dynamic panel-data estimation, one-step system GMM estimates. Lagged values of *Market Leverage* and *Utility Price* used as instruments: lagged levels are used in first-differences equations and lags of first-differenced variables are used in levels equations (see last row). All regressions include year dummies. Standard errors in parentheses are robust to heteroschedasticity and to within group serial correlation (observations are clustered by firms). AR(1) tests the null hypothesis of no first-order correlation in the differenced residuals (Arellano-Bond test is still valid if differenced errors are AR(1)). AR(2) tests the null hypothesis of no second-order correlation in the differenced residuals (Arellano-Bond test is not valid if differenced errors are AR(2)). The Sargan-Hansen statistic tests the null hypothesis that the over-identifying restrictions are valid. ***, **, * denote significance of the coefficients at 1%, 5%, and 10%.

7. Conclusion

Following the large scale privatization and structural reforms in network industries in Europe over the past 20 years, it appears that European regulated utilities in telecommunications, electricity, natural gas, water, and transportation, have accumulated large amounts of debt. This phenomenon has been described by the UK Department of Trade and Industry (DTI) and the HM Treasury (DTI-HM, 2004) as the "dash for debt," and has raised concerns among policymakers about the financial stability of regulated utilities and their ability to finance future investments. Theoretical models and earlier empirical work based on U.S data suggest however that high leverage is a natural response of regulated firms to the inability of regulators to make long-term commitments to prices. High leverage protects regulated firms against the "regulatory opportunism" — the risk that regulators will lower prices in the future once investments become sunk in order to benefit consumers at the firm's expense.

In this paper we examine this idea empirically, using a comprehensive panel of virtually all major publicly traded regulated utilities in the EU-15 member states. Our data covers firms with various degrees of state ownership that are either regulated by IRA or by ministries, governmental committees, or local governments. This heterogeneity allows us to examine the effect of private- versus state-ownership and of regulatory independence on the capital structure of regulated firms and its implications for regulated prices. Our analysis reveals that privately controlled firms tend to have a higher leverage than state-controlled firms provided that they are regulated by IRA, and that the increased leverage is associated with higher regulated prices. By contrast, we do not find a significant effect of leverage on prices in the case of state-controlled firms. These results provide strong support for the hypothesis that privately controlled regulated firms rely on debt financing as a way to induce IRA to set higher prices. To the extent that regulated firms may take "regulatory opportunism" into account when making investment decisions, our results suggest that debt financing may have some desirable consequence because it may boost the incentives of privately controlled regulated firms to invest. Of course, given that debt financing also leads to higher regulated prices and may also increase the likelihood of financial distress, it is clear that more research, both theoretically and empirically, is needed to determine if the "dash for debt" phenomenon is desirable and provides (at least in part) a solution to a regulatory opportunism problem, or whether it is an unintended consequence of the privatization of firms in network industries and should be discouraged.

Appendix A: Data Sources

Panel A. Ownership Data

Country	Individual Countries Sources 1994–2004	All Countries Sources 1994–2004
Austria	**1.** Austrian Holding and Privatisation Agency, www.oiag.at	**1.** Company Web Sites; **2.** Annual Reports; **3.** 20-F Reports; **4.** SEC, Filings & Forms (EDGAR), www.sec.gov/edgar.shtml; **5.** Hoovers Company In-dept Records; **6.** SDC Thomson Financial; **7.** Amadeus, Bureau van Dijk; **8.** Lexis Nexis, Business News; **9.** Privatization Barometer, www.privatizationbarometer.net; **10.** Financial Times; **11.** For Banks and Financial Institutions: IMF Working Paper, 2005, "State-Owned Banks, Stability, Privatization, and Growth: Practical Policy Decisions in a World Without Empirical Proof," www.imf.org/external/pubs/ft/wp/2005/wp0510.pdf
Belgium	**1.** Bureau Fédéral du Plan (BFP), www.plan.be, "Participations Publiques dans le Secteur Marchand en Belgique, 1997–2003"	
Finland	**1.** Ministry of Trade & Industry, "State—Owned Companies" Publications, 1995, 2005	
France	**1.** La Caisse des Dépôts, www.caissedesdepots.fr/FR/index.php **2.** L'Agence des participations de l'État (APE), www.ape.minefi.gouv.fr/ **3.** Euronext, www.euronext.com/home/0,3766,1732,00.html	
Germany	**1.** KfW, www.kfw.de/EN_Home/index.jsp	
Greece	**1.** Athens Stock Exchange, www.ase.gr/default_en.asp **2.** Hellenic Capital Market Commission, Annual Reports 1999–2005, www.hcmc.gr/english/index2.htm	
Italy	**1.** MEF, Dipartimento del Tesoro, "Libro bianco sulle privatizzazioni," April 2001, 2002 and 2003 **2.** MEF, Dipartimento del Tesoro, "La relazione sulle privatizzazioni," 1997–2000 **3.** MEF, Dipartimento del Tesoro, "Libro verde sulle partecipazioni dello Stato," November 1992 **4.** MEF, www.dt.tesoro.it/Aree-Docum/Partecipaz/Partecipaz/Partecipate.htm_cvt.htm	

Continued

Appendix A: Continued

	Panel A. Ownership data	
Country	Individual Countries Sources 1994–2004	All Countries Sources 1994–2004
	5. IRI (2001) "Le privatizzazioni in Italia, 1992–2000," edited by Bemporad S. and E. Reviglio	
	6. Mediobanca (2000) "Le privatizzazioni in Italia dal 1992"	
	7. Borsa Italiana, "Operazioni di Privatizzazione—Anni 1993–2006," www.borsaitaliana.it/documenti/ufficiostampa/datistorici/privatizzazioni_pdf.htm	
	8. Consob, www.consob.it	
Netherlands	**1.** Ministry of Finance, www.minfin.nl/en/subjects, government-participation	
	2. Morgan Stanley, *Journal of Applied Corporate Finance*, Vol. 9, Number 1, Spring 1996	
	3. OECD, 1998, Reforming Public Enterprises: The Netherlands	
Portugal	**1.** Ministry of Finance and Public Administration, Economic Research and Forecasting Department (DGEP), www.dgep.pt/menprinci.html	
Spain	**1.** Sociedad Estatal de Participaciones Industriales, www.sepi.es	
	2. Economic Monthly Report (1995 and 1999), La Caixa, www.lacaixa.comunicacions.com	
	3. The Comisión Nacional del Mercado de Valores (CNMV), www.cnmv.es	
Sweden	**1.** Ministry of Industry, Employment and Communication, Annual Report for Government-Owned Companies, 2000–2005,www.sweden.gov.se/sb/d/2106/a/19792	
UK	**1.** "Who Owns Whom in the UK Electricity Industry," *Electricity Association Policy Research*, June 2003	
	2. www.ukprivatisation.com	

Continued

Appendix A: Continued

Panel B: Additional company data

Data sources used to identify privatized companies through public offers of shares in EU markets, and track name changes and M&A activity

1. Thomson Financial Securities Data Corporation, SDC Platinum Global New Issues Database and Mergers & Acquisitions Database

2. Dow Jones Newswires, Dow Jones

3. The Privatization Barometer (www.privatizationbarometer.net)

Accounting and Financial Market Data

1. Worldscope

Panel C: Institutional data

Data sources used for the IRA establishment, legal protection of investors and political orientation

1. Gilardi. F. (2002) "Policy Credibility and Delegation to IRA: A Comparative Empirical Analysis," *Journal of European Public Policy*, **9(6)**, 873–893
not in use anymore?

2. Pagano, M. and Volpin, F. (2005) "The Political Economy of Corporate Governance," *American Economic Review*, **95(4)**, 1005–1030

3. Bortolotti B. and M. Faccio (2008), "Government Control of Privatized Firms," *Review of Financial Studies*, **22(8)**, 2907–2939.

Panel D: Price data

Data sources used to identify series of price indexes of final consumer prices in regulated sectors

1. EUROSTAT—New Cronos: for electricity, gas, water, telecommunications

2. National statistics and ASECAP for freight roads

Data sources for country specific interest rates

1. Long term interest rates. OECD Factbook 2006, Environmental and social statistics

Appendix B. The Sample Firms

Company	Country	Sample Period	IPO Year	Year of Privatization	Status
	Telecommunications (15 firms)				
Telekom Austria AG	Austria	1998–2005	2000	2000	PRIV
Belgacom SA	Belgium	1994–2005	2004	–	SC
TeleDanmark AS	Denmark	1994–2005	1994	1998*	PRIV
Sonera	Finland	1998–2002	1998	–	SC
France Telecom	France	1994–2005	1997	2004	PRIV
Deutsche Telekom AG	Germany	1994–2005	1996	–	SC
OTE (Hellenic Telecom Organization)	Greece	1994–2005	2000	2002	PRIV
EIRCOM	Ireland	1999–2005	–	1999	PC
Telecom Italia SpA	Italy	1994–2005	1991	1997*	PRIV
Koninklijke KPN NV	Netherlands	1994–2005	1994	1994*	PC
Portugal Telecom SA	Portugal	1994–2005	1995	1997*	PRIV
Telefonica de Espana SA	Spain	1994–2005	1987	1994	PC
Telia AB	Sweden	1997–2005	2000	–	SC
British Telecommunications PLC	UK	1994–2005	1984	1994	PC
Kingston Communications	UK	1998–2005	1999	2000	PRIV
	Electricity (27 firms)				
EVN AG	Austria	1994–2005	1989	–	SC
Verbund	Austria	1994–2005	1988	–	SC
Fortum	Finland	1994–2005	1998	–	SC
Electricité de France	France	1994–2005	2005	–	SC
MVV Energie AG	Germany	1996–2005	1999	–	SC
VEBA AG	Germany	1994–2005	1987	1994	PC
VIAG AG	Germany	1994–1999	1986	1994	PC
Public Power Corporation SA	Greece	1998–2005	2001	–	SC
Enel	Italy	1994–2005	1999	2004*	PRIV
Edison	Italy	1994–2005	–	1994	PC
AEM Milano	Italy	1996–2005	1998	2004*	PRIV
AEM Torino SpA	Italy	1999–2005	2000	–	SC
Terna (Enel)	Italy	2000–2005	2004	2004*	PRIV
EnerTad	Italy	1996–2005	–	1996	PC
EDP Electricidade de Portugal	Portugal	1994–2005	1997	2004*	PRIV
ENDESA (Empresa Nacional de Electricidad SA)	Spain	1994–2005	1988	1997	PRIV
Iberdola	Spain	1994–2005	–	1994	PC
Red Electrica de Espana SA	Spain	1995–2005	1999	1999	PRIV
Union electrica Fenosa	Spain	1994–2005	–	1994	PC
National Grid Group PLC	UK	1995–2005	1995	1995	PC
ScottishPower/Hydro-Electric	UK	1994–2005	–	1994	PC
Scottish and Southern Energy	UK	1994–2005	1990	1994	PC

Continued

Appendix B. Continued

Company	Country	Sample Period	IPO Year	Year of Privatization	Status
United Utilities	UK	1994–2005	–	1994	PC
British Energy PLC	UK	1996–2005	1996	1996	PC
Viridian	UK	1994–2005	–	1994	PC
National Power—PowerGen Ltd	UK	1994–2001	1991	1994	PC
Yorkshire Electricity Group	UK	1994–1997	1990	1994	PC
	Gas (11 firms)				
OMV AG	Austria	1994–2005	1987	1994	PC
Distrigaz SA	Belgium	2001–2005	1996	2001*	PRIV
Fluxys	Belgium	2001–2005	–	2005*	PRIV
Gaz de France	France	1994–2005	2005	–	SC
Amga SpA	Italy	1996–2005	1996	–	SC
Acsm SpA	Italy	1998–2005	1999	–	SC
SNAM Rete Gas SpA	Italy	2000–2005	2004	2000	PC
Enagas	Spain	2000–2005	–	2000	PC
Gas Natural SDG SA	Spain	1994–2005	1996	1994	PC
British Gas PLC	UK	1994–2005	1986	1994	PC
Centrica	UK	1996–2005	–	1996	PC
	Freight Roads (8 firms)				
Autoroutes du Sud de la France	France	1999–2005	2002	2005	PRIV
SAPRR (Autoroutes Paris-Rhin-Rhone)	France	2001–2005	2004	2005	PRIV
SANEF (Autoroutes du Nord et de l'Est de la France)	France	2002–2005	2005	2005	PRIV
Autostrade SpA	Italy	1994–2005	1999	1999	PRIV
Autostrada Torino-Milano	Italy	1994–2005	–	1994	PC
Sias—Società Autostrada Torino Milano	Italy	1998–2005	–	1998	PC
Brisa Auto Estradas de Portugal	Portugal	1995–2005	1997	1998	PRIV
Abertis	Spain	1994–2005	–	1994	PC
	Multiutilities (7 firms)				
Suez	France	1994–2005	1987	1994	PC
HERA	Italy	2003–2005	2003	–	SC
ACEA SpA	Italy	1998–2005	1999	–	SC
Acegas	Italy	1997–2005	2001	–	SC
Meta SpA	Italy	2002–2004	2003	–	SC
RWE	Germany	1994–2005	–	1994	PC
Fraport AG	Germany	1994–2005	2001	–	SC
	Water (13 firms)				
Vivendi	France	1994–2005	–	1994	PC
Veolia	France	2000–2005	–	2001	PRIV
Water Supply & Sewerage Systems Co of Athens	Greece	2000–2005	1999	–	SC

Continued

Appendix B. Continued

Company	Country	Sample period	IPO year	Year of privatization	Status
Thessaloniki Water	Greece	2001–2005	2001	–	SC
Acquedotto Nicolay	Italy	1994–2005	–	–	PRIV
Condotta Acque Potabili (dal 2005: Acque Potabili)	Italy	1994–2004	–	2001	PC
Severn Trent PLC	UK	1994–2005	1989	1994	PC
Yorkshire Water PLC	UK	1994–2005	1989	1994	PC
South West Water PLC	UK	1994–2005	1989	1994	PC
Anglian Water PLC	UK	1994–2005	1989	1994	PC
Thames Water PLC	UK	1994–2000	1989	1994	PC
Wessex Water PLC	UK	1994–1998	1989	1994	PC
AEA Technology PLC	UK	1997–2005	1996	1997	PC
	Airports (6)				
Flughafen Wien AG	Austria	1994–2005	1992	2000	PRIV
Kobenhavns Lufthavne A/S	Denmark	1994–2005	1994	2000*	PRIV
Aeroporto di Venezia	Italy	2002–2005	2005	–	SC
Aeroporto di Firenze SpA	Italy	1999–2005	2000	2000	SC
Aeroporti di Roma	Italy	1994–2000	1997	2000	PRIV
BAA PLC	UK	1994–2005	1987	1994	PC
	Port and Docks (5 firms)				
Piraeus Port Authority	Greece	2001–2005	2003	–	SC
Associated British Ports Hldgs	UK	1994–2005	1983	1994	PC
Forth Ports PLC	UK	1994–2005	1992	1994	PC
Mersey Docks & Harbour Co	UK	1994–2004	1970	1994	PC
Railtrack Group PLC	UK	1996–2002	1996	1996	PC

The year of privatization is the first year in which the state's stake in the firm fell under 50%. An asterisk next to the year of privatization indicates that the state holds a golden share which gives it special control rights, such as the right to appoint board members or veto proposed acquisitions. The status column indicates whether the firm is privately controlled throughout our sample (PC), state-controlled throughout our sample (SC), or was privatized during our sample period (PRIV).

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